

**FLOOD CONTROL AND METROPOLITAN DEVELOPMENT  
IN HOUSTON, MIAMI AND TAMPA, 1935-1985**

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The Academic Faculty

By

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# Flood Control and Metropolitan Development in Houston, Miami and Tampa, 1935-1985

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## **CHAPTER 1**

### **INTRODUCTION**

This research focuses on civil works projects at the intersection of metropolitan development, risk management, and changing engineering practices. Today climate change is causing oceans around the world to rise. Flooding from higher tides and tropical storms increasingly threatens major coastal cities. This dissertation focuses on three southeastern cities – Houston, Miami, and Tampa – that are particularly vulnerable to the repercussions of climate change because of their successful development on coastal plains. Although hurricanes did bring flooding to southeastern Texas and South Florida in the past, it was fresh water overflowing from rivers, bayous, and wetlands that was the primary concern of city boosters in the twentieth century.

I argue that the rapid development of Houston, Miami, and Tampa – from small cities into major regional centers in the decades after World War Two – depended on federally-sponsored systems of canals, dams, and reservoirs for controlling floods and supplying fresh water. These three metropolitan areas are representative of the kind of sprawling development that happened to major cities across the Sunbelt, but Houston, Miami, and Tampa uniquely required systems of water management to grow in hazardous, low-lying regions that otherwise would have constrained their development. Dams, water retention areas, canals, and hydraulic control structures are all components of civil works infrastructure that were implemented to achieve these goals of regional development. In all three cities this infrastructure partially solved the problem of acute



urban flooding, but, by helping to protect large areas for future development, it also heightened the vulnerability of these coastal regions to water shortages and more intense storms today. By looking at the motivations for flood control in Houston, Miami, and Tampa in the past, this research helps better define the questions we should be asking for how to prepare these kinds of low-lying regions for an even more hazardous future.

As southeastern cities, Houston, Miami, and Tampa represent both different geographies and politics from cases such as Phoenix and Los Angeles in the arid Sunbelt West.<sup>1</sup> In those cities, controlling flash floods and supplying water for irrigation and human consumption were critical barriers to suburban growth, but the federal role in developing the West was institutionalized much earlier through resource extraction followed by reclamation efforts of varying degrees of success.<sup>2</sup> In the case of Houston, Miami, and Tampa, state and local sponsors had to put up significant percentages of the construction costs. They also had to pay for all the maintenance and operation, so there was a constant struggle to justify this form of intervention in regional water resources.

In contrast to New Orleans, where a highly visible flood hazard was constantly being managed, after repeated failures, Houston, Miami, and Tampa went through periods of successful infrastructure development that then faded into the background for most residents.<sup>3</sup> In these coastal cities, disaster response was institutionalized by the

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<sup>1</sup> Andrew Needham, *Power Lines: Phoenix and the Making of the Modern Southwest*, Politics and Society in Twentieth-Century America (Princeton: Princeton University Press, 2014), 32.

<sup>2</sup> Donald J. Pisani, *Water and American Government: The Reclamation Bureau, National Water Policy, and the West, 1902-1935* (Berkeley: University of California Press, 2002), 6.

<sup>3</sup> C. L. Mohr and L. N. Powell, "Through the Eye of Katrina: The Past as Prologue? An Introduction," *Journal of American History* 94, no. 3 (December 1, 2007): 693–94, <https://doi.org/10.2307/25095129>. New Orleans was a city in a perilous location. Its levees, floodgates, and pumps were always a prominent part of the landscape of the city. Flood control infrastructure in Houston, Miami and Tampa is also visible, but you have to travel out to the suburbs

relationship between local flood control districts and on-going U.S. Army Corps of Engineers civil works projects. Flood control became an invisible presence until quite recently when the consequence of unregulated development, combined with higher tides and more intense precipitation events, led to increasing calls for new infrastructure projects.

| Houston                  | 1940 | 1950                                  | 1960                                  | 1970                                 | 1980                                  |
|--------------------------|------|---------------------------------------|---------------------------------------|--------------------------------------|---------------------------------------|
| Major floods, 1929, 1935 |      | Primary infrastructure complete, 1948 |                                       | Environmental Resistance, 1966-71    |                                       |
| Miami                    |      | Major floods, 1947                    | Primary infrastructure complete, 1964 | Environmental Resistance, 1970-1990s |                                       |
| Tampa                    |      |                                       | Major floods, 1959-60                 | Environmental Resistance, 1968-1976  | Primary infrastructure complete, 1980 |

*Figure 1.1 Comparative timeline of the lifecycle of flood control projects in Houston, Miami, and Tampa*

At mid-century the development of large flood control projects, and the repercussions of that development, followed a pattern. Each city experienced a similar sequence of events: Flood control began with determination to prevent another catastrophe, and over the next 15 years, major infrastructure was put in place

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to see it. About once a decade, a spectacularly intense downpour, or a tropical storm traveling on just the right path, would cause suburban flooding, and local water managers would have to remind citizens of the systems that had protected them from even more catastrophic damage. This revealing of the system through stress on its limits was a key part of the local media coverage of the aftermath of Hurricane Harvey in Houston in August, 2017.

successfully. But, ultimately, the protective systems imagined at the time of the original disaster were never completed. In Houston, for example, a particularly catastrophic flood in 1935 galvanized civic leaders to seek federal funding for a comprehensive project of flood control and improved navigation that would secure downtown areas from flooding and prevent damage to the critical Ship Channel for the Port of Houston.<sup>4</sup> A state-sponsored flood control district was created for Houston's Harris County to provide local financial contributions to the federal Corps of Engineers projects and to maintain the flood control infrastructure after its completion. By the late 1940s two large dams with water retention areas and outlet channels were nearing completion well outside of Houston's growing suburbs.<sup>5</sup>

The success of this infrastructure in preventing major floods had a complex relationship with the suburban sprawl that dominated the Sunbelt energy capital into the 1980s.<sup>6</sup> Downtown Houston never saw flooding again like it did in 1935, and the Port of Houston was never again forced to cease operations because of debris and silt filling up the Ship Channel. But suburban flooding became a perennial problem as new subdivisions sprawled across Harris County in the 1950s. As land values increased the costs of obtaining rights-of-way for new infrastructure, construction became prohibitively

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<sup>4</sup> K. N. White, S. D. Fitzgerald, and J. Rogers, "Inundation, District Creation, and Urbanization: The History of Flood Control in Harris County, Texas" (American Society of Civil Engineers, 2008), 1–10, [https://doi.org/10.1061/40976\(316\)148](https://doi.org/10.1061/40976(316)148).

<sup>5</sup> Lauren Caruba, "Houston Dams Are Old, Beat up and a Vital Line of Defense," *Houston Chronicle*, September 2, 2016, <http://www.houstonchronicle.com/news/houston-texas/houston/article/Houston-dams-are-old-beat-up-and-a-vital-line-of-9199908.php>.

<sup>6</sup> Barry J Kaplan, "Houston: The Golden Buckle of the Sunbelt," in *Sunbelt Cities: Politics and Growth since World War II*, ed. R. M. Bernard and B. R. Rice (University of Texas Press, 1983), 200.

expensive.<sup>7</sup> Starting in the late 1960s, pressure from grassroots environmental groups, taxpayer resistance to approving bonds, and federal budget tightening forced the suspension of drainage projects meant to prevent suburban flooding.

A variation on this sequence of events occurred in the greater Miami area following extensive flooding in the spring of 1947, and a similar pattern repeated again in the Tampa Bay area after major spring storms and Hurricane Donna flooded much of southwest Florida in 1960. In both of these postwar Florida cases the infrastructure designed by the Corps of Engineers to protect the cities took over a decade to complete, rapid growth coincided with the completion of the works, and environmental concerns became more prominent in each location, ultimately leading to critical modifications of the flood control systems.

In Miami, the destruction of the rich ecological diversity and beauty of the Everglades ecosystem became a rallying point for criticism of the flood control projects and unregulated suburban growth in South Florida.<sup>8</sup> In Tampa, federal projects were still in the planning stages as an era of increased environmental awareness began in the late 1960s. Because of resistance at the local level and federal spending cut backs in the 1970s, most of the reservoirs designed to provide structural flood control and manage

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<sup>7</sup> Harris County Flood Control District, "Wild River: A Pictorial Petition as Presented to the Subcommittee on Civil Functions, Senate Appropriations Committee," July 28, 1951, Auditors Papers, Harris County Archives; Mihir Zaveri, "Officials Patched and Prayed While Pressure Built on Houston's Dams," *Houston Chronicle*, December 17, 2017, sec. Developing Storm Part 5, <https://www.houstonchronicle.com/news/houston-texas/houston/article/Officials-patched-and-prayed-while-pressure-built-12425719.php>.

<sup>8</sup> Arthur R. Marshall, "A Critique of Water Management," in *Handbook on the Biscayne Aquifer: Water Management, Water Conservation, Health and Cost of Drinking Water*, ed. Brian Blackwelder, Brenda Marineace, and Joseph E. Podgor (Environmental Coalition of Broward County, Inc., 1981); US GAO, "Report to the Secretary of the Army: Improved Planning and Management of the Central and Southern Florida Flood Control Project Is Needed," May 14, 1982, 5, Box 9, Accession No. 077-02-0045, RG 77, National Archives at Atlanta.

water supplies in southwest Florida were never built.<sup>9</sup> Instead large areas of swamp and river basin were set aside to provide these services naturally. While the Miami case demonstrates the most severe failure to anticipate the consequences of transforming a region's water regime, flood control in Tampa shows the evolution of the Corps of Engineers as they learned to work with local water management institutions to anticipate and mitigate environmental impacts.

The Corps could not follow through on the initial plans for the Tampa Bay area's "Four River Basins" project for two main reasons. First, they ran out of money. Starting in 1969, local representatives had to repeatedly go back to Congress for larger appropriations to begin work on local reservoirs and an emergency bypass canal protecting the city of Tampa from flooding on the Hillsborough River.<sup>10</sup> With a deepening recession in the early 1970s, and subsequent administrations' determination to curtail large civil works projects, it was hard to get even a tenth of the requested budget for the multi-purpose system of reservoirs, canals, and levees that was planned to protect agricultural areas in southwest Florida, provide abundant fresh water supplies, and encourage suburban development.<sup>11</sup> Funds for flood control projects were also competing with the need to deepen the channel through Tampa Bay into the Port of Tampa. These constraints forced the Corps and the Southwest Florida Water Management District to

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<sup>9</sup> US Army Corps of Engineers Jacksonville District, "Four River Basins Project Inactive Status," April 1986, Box 9, Accession No. 077-02-0045, RG 77, National Archives at Atlanta.

<sup>10</sup> Sam M. Gibbons, "Statement of Congressman Sam M. Gibbons Before Public Works Subcommittee of the House Appropriations Committee," June 4, 1969, Sam Gibbons Papers, 1971-1, University of South Florida Libraries.

<sup>11</sup> Sam M. Gibbons, "Statement of Congressman Sam M. Gibbons Before Public Works Subcommittee, Appropriations Committee," May 15, 1973, Sam Gibbons Papers, 1978-9, University of South Florida Libraries.

focus on the single purpose that was absolutely essential in the system: providing emergency flood relief to the city of Tampa. The Tampa Bypass Canal became the one remaining non-negotiable piece of the Four River Basins project, completed in 1981.<sup>12</sup>

Second, grassroots environmental concerns were forcing a shift in the way in which water supply and flood control projects were designed. In the late 1960s University of South Florida biologists and local Tampa environmental groups stopped Old Tampa Bay from being transformed into a fresh water lake.<sup>13</sup> State-wide environmental activism and distrust of large-scale projects put a stop to plans for the Cross-Florida Barge Canal – an essential outlet for several Four River Basins reservoirs. Meanwhile, air and water quality concerns merged into a national movement that would result in legislation for federal regulation.<sup>14</sup> The Corps of Engineers put most of the remaining Four River Basins projects on “inactive” status. But the local coordinating organization for the projects, the Southwest Florida Water Management District, captured the new approach to environmental engineering by purchasing and protecting lands that could alternately flood and supply fresh water.<sup>15</sup> Federal and state environmental regulations affected flood control projects in all three cities, but the Tampa case especially shows dramatic changes to the process of designing infrastructure in the 1970s. This dissertation seeks to probe

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<sup>12</sup> Southwest Florida Water Management District, “A Plan for the Use and Management of the Tampa Bypass/Harney Canal,” 1990, 4, <http://www15.swfwmd.state.fl.us/LibraryImages/00595.pdf>.

<sup>13</sup> William Taft, “Editorial: Fresh Water Lake Answer,” June 2, 1965, Sam Gibbons Papers, University of South Florida Libraries.

<sup>14</sup> Carolyn Merchant, *The Columbia Guide to American Environmental History* (Columbia University Press, 2005), 177.

<sup>15</sup> Southwest Florida Water Management District, “A Plan for the Use and Management of the Lower Hillsborough Flood Detention Area,” August 30, 2005, 11, [https://www.swfwmd.state.fl.us/recreation/pdf/2005\\_Lower\\_Hillsborough\\_FDA\\_LU-Mgmt\\_Plan.pdf](https://www.swfwmd.state.fl.us/recreation/pdf/2005_Lower_Hillsborough_FDA_LU-Mgmt_Plan.pdf).

these tensions between precaution and development that shaped infrastructure to protect vulnerable coastal areas from the kind of flooding they faced in the past.

### **How comparable are Houston, Miami, and Tampa?**

Houston, Miami, and Tampa are strong sites for a comparative case study. They are southeastern sunbelt cities that grew rapidly after World War Two to similar metropolitan population levels. Between 1940 and 1980, Houston more than quadrupled its population, from just below 400,000 to nearly 1.6 million residents.<sup>16</sup> During that same period Miami-Dade County's population increased by more than five times, also to just over 1.6 million residents.<sup>17</sup> The Tampa Bay area was slower to take off but saw nearly 50 percent growth during the 1970s. Migration, cheap housing, highways, service jobs, and, of course, air-conditioning, were factors in this staggering growth which was part of a national demographic and political realignment.<sup>18</sup> This research addresses the role of flood control in this postwar expansion by focusing on large Sunbelt cities that were not generally considered vulnerable to disaster during the period of their most rapid growth.

Despite their similar size and geography, Houston, Miami, and Tampa had very different regional economies. This distinction was most reflected in their different

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<sup>16</sup> City of Houston, "Historical Population 1900-2013," 2013, [http://www.houstontx.gov/planning/Demographics/docs\\_pdfs/Cy/coh\\_hist\\_pop.pdf](http://www.houstontx.gov/planning/Demographics/docs_pdfs/Cy/coh_hist_pop.pdf).

<sup>17</sup> US Census Bureau, "Census of Population and Housing," 2015, <http://www.census.gov/prod/www/decennial.html>.

<sup>18</sup> Gary R. Mormino, *Land of Sunshine, State of Dreams: A Social History of Modern Florida*, 1. paperback print, The Florida History and Culture Series (Gainesville, Fla.: University Press of Florida, 2008); Elizabeth Tandy Shermer, *Sunbelt Capitalism: Phoenix and the Transformation of American Politics* (Philadelphia: University of Pennsylvania Press, 2013); Robert S Thompson, "'The Air-Conditioning Capital of the World': Houston and Climate Control," in *Energy Metropolis: An Environmental History of Houston and the Gulf Coast*, ed. Martin V. Melosi and Joseph A. Pratt, History of the Urban Environment (Pittsburgh, Pa: University of Pittsburgh Press, 2007).

histories as port cities. In Texas, the Corps of Engineers dredged the fifty-mile-long Houston Ship Channel from Galveston Bay on the Gulf of Mexico. When the ship channel was completed in 1914, oceangoing vessels could load goods directly in downtown Houston.<sup>19</sup> After the destruction of the Port of Galveston by a major hurricane in 1900, this protected, inland location was one selling point for attracting large oil and gas infrastructure investments to the ship channel region.<sup>20</sup> Miami also encountered strong storms early on – most famously suffering extensive hurricane damage in 1926 and again in 1928. Miami, however, persistently focused on real estate and tourist-oriented development, especially along its beaches and bay front.<sup>21</sup> Due to its location and changing demographics, international finance and logistical services were a secondary economic niche. The Port of Miami became the country's largest cruise port and a transshipment center for goods coming from Latin America. Meanwhile, the Port of Tampa served an agricultural hinterland, with a long history of direct trade with Cuba and the Caribbean, especially in its key exports of cigars, cattle, and citrus.

#### A regional framework for analysis

Local economic differences aside, flood control in all of these cases was intimately connected with a common push for regional development. Houston's dams on Buffalo Bayou, for example, were designed to maintain the Houston Ship Channel as a

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<sup>19</sup> Marilyn McAdams Sibley, *The Port of Houston: A History* (University of Texas Press, 1968), 150.

<sup>20</sup> Martin V. Melosi and Joseph A. Pratt, "The Energy Capital of the World? Oil-Led Development in Twentieth-Century Houston," in *Energy Capitals: Local Impact, Global Influence*, ed. Joseph A. Pratt, Martin V. Melosi, and Kathleen A. Brosnan, *History of the Urban Environment* (Pittsburgh, Pa: University of Pittsburgh Press, 2014), 37.

<sup>21</sup> Raymond A. Mohl, "Miami: The Ethnic Cauldron," in *Sunbelt Cities: Politics and Growth since World War II*, ed. R. M. Bernard and B. R. Rice (University of Texas Press, 1983), 60.



stable deep water port and petrochemical corridor. Flood control in Houston was about preventing urban flooding so that both the port and the city could continue rapidly expanding. Raymond Mohl initially called for historians to look at metropolitan development within this regional framework, and his work on Miami pointed to its growing role in the movement of goods and people from Latin America and the greater Caribbean during the 1960s.<sup>22</sup> During the same period, much of the Tampa Bay area was still rural and aligned with key agricultural interests, such as citrus growers and ranchers in Hillsborough and Pasco Counties, while Pinellas County's urban population boomed around St. Petersburg.<sup>23</sup>

Kevin Kruse and Thomas Sugrue note that suburbs took many different forms depending on the local political economy and became more diverse over time.<sup>24</sup> Andrew Needham points to the case of electric power utilities in Phoenix to show that a regional focus can illustrate the hidden impacts of infrastructure development beyond the city it directly serves.<sup>25</sup> Foundational studies of mid-century suburban expansion have cited the importance of federal housing subsidies, rural decline, and highway development in shifting the balance of political power away from core cities.<sup>26</sup> This research contributes

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<sup>22</sup> Raymond A. Mohl, "City and Region: The Missing Dimension in US Urban History," *Journal of Urban History* 25, no. 1 (1998): 3–22.

<sup>23</sup> Pinellas County Planning Department, "Pinellas County Historical Background," December 2008, 7–9, [http://www.pinellascounty.org/Plan/pdf\\_files/PCHB.pdf](http://www.pinellascounty.org/Plan/pdf_files/PCHB.pdf); Editorial, "When the Rain Barrel Goes Dry...", *Tampa Tribune*, June 10, 1973, Sam Gibbons Papers, University of South Florida Libraries.

<sup>24</sup> Kevin Michael Kruse and Thomas J. Sugrue, eds., *The New Suburban History*, Historical Studies of Urban America (Chicago: University of Chicago Press, 2006), 7.

<sup>25</sup> Needham, *Power Lines*, 6.

<sup>26</sup> Kenneth Jackson, *Crabgrass Frontier: The Suburbanization of the United States* (Oxford: Oxford University Press, 1987); Adam Ward Rome, *The Bulldozer in the Countryside: Suburban Sprawl and the Rise of American Environmentalism*, Studies in Environment and History (Cambridge ; New York: Cambridge University Press, 2001).

to scholarship in urban history by showing the role of flood control in creating the conditions for sprawl along with other well-established factors in these particular coastal cities.

### **Connections to other studies of civil works**

Flood control projects in Houston, Miami, and Tampa fit into three broad periods of historical scholarship on civil works, natural hazards, and water resources management. Houston's dams represented an extension of New Deal flood control that had already been active on the Mississippi, in the Tennessee Valley, and the Colorado River in Texas.<sup>27</sup> Miami's extensive levees, canals, and water conservation areas represented a regional push for immediate postwar suburban development.<sup>28</sup> And the complex designs for Tampa's infrastructure were initially planned for agricultural development in a part of the state that was slowly moving away from that way of life in the 1960s.<sup>29</sup> These contrasting goals show how flood control served multiple interests at different times in different places. While past scholarship has focused on flood control for both industrial and agricultural development, the connection to suburban sprawl and regional development has been less discussed.

In the twentieth century, transforming nature to serve development became a national project from the arid deserts of the West to southern swamps. Civil works for flood control and water supply were often interrelated in a variety of environments where

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<sup>27</sup> C. Herman Pritchett, *Tennessee Valley Authority: A Study in Public Administration* (The University of North Carolina Press, 2014), 47; Sarah T. Phillips, *This Land, This Nation: Conservation, Rural America, and the New Deal* (New York, NY: Cambridge University Press, 2007), 158.

<sup>28</sup> N. D. B. Connolly, *A World More Concrete: Real Estate and the Remaking of Jim Crow South Florida* (Chicago: University Of Chicago Press, 2014), 143.

<sup>29</sup> William B. Stronge, *The Sunshine Economy: An Economic History of Florida since the Civil War* (Gainesville, Fla.: Univ. Press of Florida, 2008), 19.

seasonal changes made agriculture difficult. “The values of easterners and westerners showed remarkable consistency through time,” Donald Pisani writes. “Those who drained wetlands and those who built dams for irrigation both believed that the landscape was infinitely malleable. Human beings could at least ‘finish’ nature, if not redesign it.”<sup>30</sup> Pisani notes that water and development projects have always had a governmental and a private component. Railroads were champions of the Reclamation Act of 1902 and railroads, timber companies, and land agents pushed states to pass drainage laws. There were impressive early successes, such as the Salt River Project in southern Arizona, alongside less transformative projects. The entrepreneurial, and often hopelessly indebted, drainage districts in South Florida and East Texas were the legacy of this early period of public-private water control and state-level land development.

### The New Deal

Beginning in the Great Depression of the early 1930s, the New Deal greatly increased the scale of federal involvement in flood control projects. Jameson Doig points out that impressive earlier civil works, such as the George Washington Bridge, built under the Port Authority of New York and completed in 1931, demonstrated to Governor Roosevelt the key role of an autonomous authority in carrying out largescale, regional projects above the local political fray.<sup>31</sup> The Tennessee Valley Authority (TVA), based on this model, with direct federal backing in 1933, sought to restore agricultural vitality

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<sup>30</sup> Donald J. Pisani, “Beyond the Hundredth Meridian: Nationalizing the History of Water in the United States,” *Environmental History* 5, no. 4 (2000): 466–82.

<sup>31</sup> Jameson W. Doig, “Expertise, Politics, and Technological Change The Search for Mission at the Port of New York Authority,” *Journal of the American Planning Association* 59, no. 1 (March 31, 1993): 31–44, <https://doi.org/10.1080/01944369308975843>.

to impoverished lands through a combination of soil conservation, flood control, and, in a break from past civil works, rural electrification.

TVA's success was largely industrial and symbolic. As Bruce Schulman argues, TVA initially focused on making the Tennessee River more navigable and on the production of cheap fertilizer as ways of supporting the rural economy without reorganizing it.<sup>32</sup> When these measures did not bring employment or wages past pre-recession levels, TVA began to encourage industrial relocation to the region. The outbreak of the Second World War solved TVA's economic growth problems. It was its large-scale, industrial, war-production capacity, based on cheap power, that became most tantalizing as a symbol of government investment.<sup>33</sup> Ultimately TVA became a model for government-sponsored rural development that the U.S. would attempt to replicate throughout the world.<sup>34</sup>

There were other New Deal projects that arguably had a greater impact on regional development. Pisani notes that Boulder Dam, built by the Bureau of Reclamation and completed in 1936, was linked to the growth of Southern California, in terms of both water and power, that affected the lives of millions and provided for wartime industries.<sup>35</sup> Competition and negotiation between powerful federal agencies, such as the Corps of Engineers versus the Bureau of Reclamation, set apart projects in the arid West from

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<sup>32</sup> Bruce J. Schulman, *From Cotton Belt to Sunbelt: Federal Policy, Economic Development, and the Transformation of the South, 1938-1980* (Duke University Press, 1994), 35.

<sup>33</sup> Thomas P. Hughes, *American Genesis: A Century of Invention and Technological Enthusiasm, 1870-1970* (Chicago: University of Chicago Press, 2004), 375.

<sup>34</sup> Nick Cullather, *The Hungry World: America's Cold War Battle Against Poverty in Asia* (Harvard University Press, 2010), 132.

<sup>35</sup> Pisani, *Water and American Government*, 227.

many in the Southeast. Boulder Dam also represented a critical early conflict over the federal development of western resources, one that would be repeated after the war. In this case, a private utility, Southern California Edison, was allowed to run generators at the dam and sell power in California.<sup>36</sup>

In the case of the New Deal in Los Angeles, Sarah Elkind writes that the local chamber of commerce became the “recognized representative of public opinion” on which projects should be selected and their benefit to the community.<sup>37</sup> Federal policy was in fact responsive to local needs for economic development. “Because the federal government relied heavily on local leaders, both within and outside government, to articulate goals for federal programs in urban areas,” Elkind writes, “the entry of the Army Corps of Engineers, the Bureau of Reclamation, and other agencies into the field of urban public works did not substantially reorganize political influence in local government.”

William Kahrl argues that the case of Southern California was different, however, from other western water projects, beginning with the “overwhelming” success of the Los Angeles Aqueduct in the early twentieth century. It provided “a forceful demonstration of the efficacy of a public water development,” Kahrl writes. “Los Angeles’ approach to water development was muscular, competitive, and self-reliant; and these same virtues

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<sup>36</sup> Sarah S. Elkind, *How Local Politics Shape Federal Policy: Business, Power, and the Environment in Twentieth-Century Los Angeles* (Chapel Hill: UNC Press, 2014), 12.

<sup>37</sup> Elkind, 4.

were reflected as well in the later construction of the Colorado Aqueduct and California's State Water Project."<sup>38</sup>

Los Angeles made good use of programs to encourage water resources development from every level of government. In 1938, after two decades of local financing and failure to control flooding on the Los Angeles River, the county turned to the federal government and the Corps of Engineers to permanently "glue the Los Angeles River in place." In a comprehensive plan very similar to the one approved two years later for Houston, the Corps built earthen dams and flood control basins and lined the river's channel with concrete.<sup>39</sup> The Flood Control Act of 1936 officially expanded the mission of the Corps of Engineers to controlling floods.<sup>40</sup> It also authorized the Corps to work on non-navigable waterways like the Los Angeles and San Gabriel Rivers and the upper reaches of Houston's Buffalo and White Oak Bayous for this purpose. As with the case of downtown Houston and its port versus the interests of rural Harris County, Elkind notes that Los Angeles River project also reflected the local balance of power. The Los Angeles Chamber of Commerce represented industrial business interests in the Long Beach area against small suburban farmers in the San Gabriel Valley far upstream.<sup>41</sup>

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<sup>38</sup> William L Kahrl, *Water and Power: The Conflict over Los Angeles' Water Supply in the Owens Valley* (Berkeley: University of California Press, 1982), 13, <http://site.ebrary.com/id/10676271>.

<sup>39</sup> William Deverell and Tom Sitton, *Water and Los Angeles: A Tale of Three Rivers, 1900-1941* (University of California Press, 2016), 11.

<sup>40</sup> William F Willingham, "The U.S. Moves towards More Integrative Approaches to Water Resources Management, 1970-2010," in *Two Centuries of Experience in Water Resources Management: A Dutch-U.S. Retrospective*, ed. John Lonnquest et al. (Institute for Water Resources, U.S. Army Corps of Engineers, 2014), 302, [http://www.iwr.usace.army.mil/Portals/70/docs/iwrreports/Two\\_Centuries.pdf](http://www.iwr.usace.army.mil/Portals/70/docs/iwrreports/Two_Centuries.pdf).

<sup>41</sup> Elkind, *How Local Politics Shape Federal Policy*, 11.

In central Texas, the Lower Colorado River Authority (LCRA), authorized in 1934, was modeled on the TVA and similarly focused on hydroelectric power, flood control, and rural welfare. Sarah Phillips argues that the LCRA's goals were based on a New Deal theory that rural recovery would drive urban recovery.<sup>42</sup> In theory, prosperous small farmers would restart city industries by buying manufactured goods. But as was the case in the Tennessee Valley, rural recovery in central Texas was slow, and champions of the LCRA, such as Congressman Lyndon Johnson, soon looked to cheap electricity to boost larger ranchers and bring new industries to the region. Phillips also points out that World War Two was a turning point where New Deal idealism could fully give way to the necessities of wartime production and the reality of industrial jobs. Houston's flood control system finally became a reality because of the value of the Port of Houston and the petrochemical industries along the Houston Ship Channel to the war effort.

### Postwar projects

Suburban flood control would become a defining issue of the postwar period, but at first the late 1940s and early 1950s saw a continuation and expansion of New Deal-era projects that had taken a pause during the war. After World War Two, business elites continued to lobby for federal funding that could solve local water challenges and allow development in their cities to accelerate. In California, the Bureau of Reclamation completed the stalled Central Valley Project, supporting incredibly productive agricultural lands, prosperous farmers, and growing coastal cities.<sup>43</sup> Donald Worster

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<sup>42</sup> Phillips, *This Land, This Nation*, 224.

<sup>43</sup> Donald Worster, *Rivers of Empire: Water, Aridity, and the Growth of the American West* (Oxford, England; New York: Oxford University, 1992).

famously claimed that by the 1940s, a new “hydraulic society” was emerging in central California. It was run by “federal technicians, indefatigable in their reorganization of natural watersheds, in sending the flow up and down hill, in making reasonable what they saw as irrational.”<sup>44</sup> In the Southeast, the TVA completed the navigation project on the Tennessee River and began building coal power plants to serve new industries that had located in the region. And in Miami the deficiencies in the 1937 Herbert Hoover Dike surrounding Lake Okeechobee would lead to the massive Central and Southern Florida Project that would transform how water moved through South Florida.<sup>45</sup>

The rapid expansion of low-density, car-dependent subdivisions of single-family homes most defines the immediate postwar period in all three cities. In Houston, Miami, and Tampa, the new suburbs put thousands of young families in the path of flooding that had previously affected sparsely settled rural areas. In Houston, recurrent suburban flooding forced county leaders to continue flood control efforts locally while renewed federal funding was slow to be approved. In contrast, during the same period in Miami, widespread suburban flooding was the most salient justification for comprehensive, regional flood control on a regional scale.<sup>46</sup>

In the last years of World War Two unprecedented federal subsidies began to be channeled towards homeowners through Federal Housing Administration and

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<sup>44</sup> Worster, 256.

<sup>45</sup> Matthew C. Godfrey and Theodore Catton, *River of Interests: Water Management in South Florida and the Everglades, 1948-2010* (Washington, D.C: Published for the U.S. Army Corps of Engineers, Jacksonville District, by the Government Printing Office, 2011), 9.

<sup>46</sup> US Congress Committee on Public Works, *Comprehensive Report on Central and Southern Florida for Flood Control and Other Purposes* (U.S. Government Printing Office, 1949), 32.



Department of Veterans Affairs mortgage insurance and very generous tax benefits.<sup>47</sup> In his now classic work on American suburbs, *Crabgrass Frontier*, Kenneth Jackson argues that suburban development was also subsidized through the absence of regulation and tax credits for new construction that greatly outweighed any benefit for renovating existing structures. “Suburbanization was not an historical inevitability created by geography, technology, and culture, but rather the product of government policies,” Jackson writes. “In effect, the social costs of low-density living have been paid by the general taxpayer rather than only by suburban residents.”<sup>48</sup> In the 1950s, Houston’s taxpayers first supported – and then consistently rejected – county attempts to raise funds for suburban flood control.

New infrastructure of various types – such as suburban water and sewer systems – were also given federal support over aging urban systems. In the 1950s, gasoline taxes massively funded interstate highways that provided access to subdivisions even farther from central cities. In the Sunbelt, civic leaders actively sought significant Cold War defense investments in growing suburban areas.<sup>49</sup> In Miami, flood control was another type of state-championed, postwar infrastructure investment in the future of its suburbs.

Most importantly for flood control, the influential work of geographer Gilbert White highlighted the role of unregulated suburban development in exacerbating floods.<sup>50</sup> Despite billions of dollars spent combating floods through protective infrastructure, flood

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<sup>47</sup> Jackson, *Crabgrass Frontier*, 204.

<sup>48</sup> Jackson, 293.

<sup>49</sup> Roger W Lotchin, *Fortress California, 1910-1961: From Warfare to Welfare* (New York: New York : Oxford University Press, 1992), 2.

<sup>50</sup> Rome, *The Bulldozer in the Countryside*, 153.

damages increased in the 1950s as cheap land in floodplains was rapidly developed. White pushed policy-makers “to think more deeply about the ways people used floodplains,” Adam Rome argues. “What types of occupancy would yield maximum returns to society with minimum social costs?” White’s work fed into a growing skepticism about the role of civil works.

A related problem southeastern sunbelt cities faced was a failure to anticipate the rapid speed and scale of postwar development. Infrastructure planned in the late 1940s could not protect the sprawl that developed in the 1950s in both Houston and Miami. In the case of Tampa, the failure to create alternate sources of water supply seemed increasingly shortsighted by the 1980s. In his dissertation on Atlanta, Eric Hardy discusses this failure of anticipation along with other factors that contributed to the city’s perennial struggles with adequate water supplies and sewage infrastructure.<sup>51</sup> One of the main causes that Hardy cites, other than shortsightedness and a desire to keep utility rates low, is the fragmentation of regional authority. Atlanta could not come up with a comprehensive, integrated water management plan because it is so fragmented across counties and municipalities. In the cases of both Miami and Tampa, in contrast, regional water management districts were able to provide some form of comprehensive planning, even as political struggles between local authorities escalated.

By the late 1950s, efforts to replicate the TVA’s multipurpose dams in other parts of the country were running into increasing resistance. Beginning in the West, dramatic cases of unfinished Bureau of Reclamation projects, such as the Hells Canyon High Dam

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<sup>51</sup> Eric M. Hardy, “Policy Drought: Water Resource Management, Urban Growth, and Technological Solutions in Post-World War II Atlanta” (Georgia Institute of Technology, 2011), 2, <https://smartech.gatech.edu/handle/1853/50109>.

in Idaho and the Echo Park Dam in Colorado, again demonstrated the political power of local antigovernment sentiment concerning the federal development of western resources.<sup>52</sup> In the case of Hells Canyon, the Idaho Power Company successfully sought to privately develop hydropower on the Snake River, ultimately dooming what would have been the highest dam in the country. In the case of Echo Park in Dinosaur National Monument, conservation organizations, led by the Sierra Club, successfully launched a national campaign to prevent the flooding of an area of spectacular natural beauty on the Green River.<sup>53</sup> Mark Harvey argues that postwar affluence finally allowed wilderness preservation to “come of age” as millions of middle-class families visited American national parks and monuments. Tampa’s partially-completed flood control system, albeit on a smaller scale and designed for different purposes, fits in with these cases of shelved water development projects of the 1950s and 1960s.

In the Southeast, Christopher Manganiello documents similar kinds of resistance from local power companies and conservationists to large, multipurpose dams on the Savannah River during this period.<sup>54</sup> In contrast to some of the western cases, the Savannah River dams, including Hartwell, Clarks Hill (Strom Thurmond), and Trottlers Shoals (Richard B. Russell), were all completed by the 1970s. Nationally, the mid-1960s actually saw the peak of traditional infrastructure interventions in river systems.<sup>55</sup> But

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<sup>52</sup> Karl Boyd Brooks, *Public Power, Private Dams: The Hells Canyon High Dam Controversy* (University of Washington Press, 2006), 6.

<sup>53</sup> Mark W. T. Harvey, *A Symbol of Wilderness: Echo Park and the American Conservation Movement*, 1st ed (Albuquerque: University of New Mexico Press, 1994), 259.

<sup>54</sup> Christopher J. Manganiello, *Southern Water, Southern Power: How the Politics of Cheap Energy and Water Scarcity Shaped a Region* (UNC Press Books, 2015).

<sup>55</sup> Willingham, “The U.S. Moves towards More Integrative Approaches to Water Resources Management, 1970-2010,” 287. During the 1960s and 1970s, the Corps completed 149 major dams and the Soil Conservation Service completed 2000 small watershed dams. “In fact,” Willingham

Manganiello argues that the negotiation process over the location and scale of these projects was a significant departure from earlier New South and New Deal boosterism and the old narrow focus on water supply alone. “The countryside conservationists and environmentalists repeatedly used water quality to justify a range of positions,” Manganiello writes. “They had an appetite for economic development, but not at the expense of southern waterways and certainly not at the expense of water quality in the massive federal reservoirs that were supposed to drive the Sun Belt’s growing recreational and service-based economy.”<sup>56</sup>

#### Water resources development

By the late 1960s, a fundamental shift in the goals of civil works for flood control was underway. Quality of life concerns arose along with suburban sprawl. Adam Rome documents ways in which the growing environmental movement of the 1960s was connected to concerns about suburban expansion.<sup>57</sup> For example, issues like water quality became prominent through visible pollution from poorly maintained suburban septic systems and non-biodegradable detergents. Middle-class homeowners also became champions of preserving recreational open space against the poor aesthetics of rapid land development.

The dramatic environmental resistance to completing the later phases of Miami’s flood control system in the Everglades, which was led by local conservationists as well as

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points out, “50 percent of the Corps’ water resources projects built from 1900 to 1989 were constructed between 1960 and 1980.”

<sup>56</sup> Manganiello, *Southern Water, Southern Power*, 145.

<sup>57</sup> Rome, *The Bulldozer in the Countryside*, 143.

national organizations such as National Audubon Society, also reflected the changing focus to water quality and recreational issues in the late 1960s.<sup>58</sup> Robert Gottlieb highlights the grassroots, urban-focused environmental organizations that championed causes such as reducing industrial water pollution, improving air quality, and preserving natural areas as city parks.<sup>59</sup> He argues that this local side of the 1960s environmental movement connects with early twentieth century Progressive-era public health campaigns and should be recognized along with the mainstream champions of natural beauty and wildlife like National Audubon Society and the Sierra Club. Grassroots organizations that opposed flood control on aesthetic grounds, such as the Buffalo Bayou Preservation Association in Houston, were also deeply concerned about water pollution issues.<sup>60</sup>

By the end of the 1960s, as local recognition of recurrent suburban flooding became more widespread, Gilbert White's approach to restricting development in floodplains reached the level of federal policy. The National Flood Insurance Program (NFIP) of 1968 subsidized insurance for homeowners living in high risk areas, if local governments took steps to mitigate the flood hazard or regulate future development in floodplains.<sup>61</sup> The Corps of Engineers and the United States Geological Survey identified

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<sup>58</sup> Godfrey and Catton, *River of Interests*, 56; David P. Billington, Donald C. Jackson, and Martin V. Melosi, *The History of Large Federal Dams: Planning, Design, and Construction in the Era of Big Dams* (Denver, CO: U.S. Dept. of the Interior, Bureau of Reclamation, 2005), 400.

<sup>59</sup> Robert Gottlieb, *Forcing the Spring: The Transformation of the American Environmental Movement* (Island Press, 1993).

<sup>60</sup> Teresa Tomkins-Walsh, "'A Concrete River Had to Be Wrong': Environmental Action on Houston's Bayous, 1935–1980" (University of Houston, 2009), 15, ProQuest Dissertations & Theses A&I.

<sup>61</sup> Scott Gabriel Knowles and Howard C. Kunreuther, "Troubled Waters: The National Flood Insurance Program in Historical Perspective," *Journal of Policy History* 26, no. 03 (July 2014): 327–53. Houston, Miami and Tampa all eventually joined the NFIP, after taking some steps to limit development in floodplains. But this has barely mitigated catastrophic losses, as Knowles and Kunreuther have pointed out.

hazardous locations and developed local flood zone maps for the program. Knowles and Kunreuther point out, however, that many communities did not initially join the NFIP because of pressure from developers and local governments. “Faced with restricting development or taking chances on a hurricane and hoping for disaster-relief payments,” they write, “it is clear that many communities in the early NFIP years chose to take their chances.”

The growing emphasis on floodplain management in the 1970s coincided with a dramatic increase in environmental regulations and cuts to civil works budgets.<sup>62</sup> In the decade prior to the Water Resources Development Act of 1986 (WRDA-86), there were no major Congressional authorizations for water-related civil works. For the Corps of Engineers, the 1970s were a decade of trying to more skillfully anticipate and mitigate environmental impacts associated with large projects. The Corps worked with a professional environmental advisory board, developed technical capacities to prepare environmental impact statements that would stand up to litigation, and gathered data to support non-structural approaches to flood control.

Under the Reagan administration, WRDA-86 was a paradigmatic and organizational turning point for civil works projects carried out by the Corps of Engineers.<sup>63</sup> Crucially, WRDA-86 forced at least 25 percent cost-sharing for all phases of all projects with local sponsors. In previous decades, cost-sharing had varied greatly, and it had often been part of the negotiations between the federal government and local

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<sup>62</sup> Willingham, “The U.S. Moves towards More Integrative Approaches to Water Resources Management, 1970-2010,” 288.

<sup>63</sup> Martin Reuss, “Reshaping National Water Politics: The Emergence of the Water Resources Development Act of 1986” (US Army Corps of Engineers Institute for Water Resources, October 1991), 1.

officials. For example, raising local contributions had been a key hurdle to overcome for the projects in Houston and Miami. County and state leaders in Texas and Florida came up with many creative ways to raise funds, or otherwise bend the rules, to get projects started and continue funding them across decades.

WRDA-86 also galvanized the Corps' work in environmental remediation. It expanded cost-benefit calculations to include measures of environmental impact and restoration, although these remained difficult to quantify.<sup>64</sup> It allowed the Corps to review completed projects, and modify them if necessary, to prevent further environmental degradation. This review process set the stage for Everglades restoration in South Florida that started in earnest in the late 1990s.

As a result of these societal changes and paradigmatic shifts in engineering practice, water management projects started to look quite different in the 1990s. In Houston, concrete-lined bayous were transformed into city parks with extended flood zones. The Corps of Engineers efforts to “fix the plumbing” in order to restore the Florida Everglades to something approaching their natural state have been far more expensive, and extensive, than the original Miami flood control projects.<sup>65</sup> Meanwhile, Tampa's Water Management District has continued to take a lead in protecting fresh water sources and river flood zones from development.

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<sup>64</sup> William F Willingham, “U.S. Era of Progressivism and Large Public Works,” in *Two Centuries of Experience in Water Resources Management: A Dutch-U.S. Retrospective*, ed. John Lonnquest et al. (Institute for Water Resources, U.S. Army Corps of Engineers, 2014), 238, [http://www.iwr.usace.army.mil/Portals/70/docs/iwrreports/Two\\_Centuries.pdf](http://www.iwr.usace.army.mil/Portals/70/docs/iwrreports/Two_Centuries.pdf).

<sup>65</sup> Godfrey and Catton, *River of Interests*, 124.

## Natural hazards and environmental justice

A different line of interdisciplinary scholarship has focused on natural hazards, local vulnerability to natural disasters, and campaigns to achieve greater environmental justice. Flood control projects in Houston, Miami, and Tampa were all born from disasters – dramatic events that brought flooding at a scale never before seen in those cities. The disasters that inspired the political effort towards securing significant federal flood control in each city were not their first major flood, nor the last. They were, however, occurring at moments of particularly heightened vulnerability in each city. These were times when rapid development had ignored natural hazards and exposed growing downtowns and suburbs to widespread damage.

Since the 1960s, a critical line of scholarship on *vulnerability* has focused on the unequal impacts of natural disasters on different socioeconomic groups.<sup>66</sup> The legacy of distinct urban politics, infrastructure development, land use, property values, and social services produces vulnerabilities that are “revealed” when a storm disrupts the normal functioning of a city.<sup>67</sup> From this critical perspective, the concept of a “natural” disaster denies the policy choices that constructed such unequal vulnerabilities.<sup>68</sup> Andrew Lakoff argues that vulnerability research, originally conducted under the Cold War-era Office of

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<sup>66</sup> Scott Gabriel Knowles, *The Disaster Experts: Mastering Risk in Modern America* (Philadelphia: University of Pennsylvania Press, 2011), 245.

<sup>67</sup> Dennis S. Mileti, *Disasters by Design: A Reassessment of Natural Hazards in the United States*, Natural Hazards and Disasters (Washington, D.C.: Joseph Henry Press, 1999).

<sup>68</sup> S. Hilgartner, “Overflow and Containment in the Aftermath of Disaster,” *Social Studies of Science* 37, no. 1 (February 1, 2007): 153–58, <https://doi.org/10.1177/0306312706069439>; Scott Gabriel Knowles, “Learning from Disaster?: The History of Technology and the Future of Disaster Research,” *Technology and Culture* 55, no. 4 (2014): 773–84, <https://doi.org/10.1353/tech.2014.0110>; Theodore Steinberg, *Acts of God the Unnatural History of Natural Disaster in America* (New York: Oxford University Press, 2006).



Civil Defense, highlighted many difficult socioeconomic problems that did not have easy political solutions. By the 1980s, a change to “all hazards” research, and the doctrine of “emergency preparedness” under FEMA, would create a more politically acceptable way of handling repeated major disasters.<sup>69</sup> Scott Knowles and Howard Kunreuther argue that there continues to be a significant “disaster science-policy action gap”; disaster experts take a long time to generate actionable, scientifically-valid data for policymakers to implement.<sup>70</sup> Disasters are thus critical moments to evaluate the development of sociotechnical systems.

New Orleans as a case study of the failure of these systems has been continually reassessed as different causal factors have come to light to explain the 2005 flooding tragedy following Hurricane Katrina.<sup>71</sup> The vulnerability model remained valid for some scholars, as the storm clearly revealed layers of inequitable risk exposure due to socioeconomic structures.<sup>72</sup> There were also technical failures to design and build specific structures to be robust enough for major hurricanes, and there were organizational failures to consistently plan an adequate system of protective works over many decades.<sup>73</sup> Ten years after Katrina, evidence pointed to compromises made between

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<sup>69</sup> Andrew Lakoff, “Preparing for the next Emergency,” *Public Culture* 19, no. 2 (2007): 247.

<sup>70</sup> Knowles and Kunreuther, “Troubled Waters,” 344.

<sup>71</sup> W. Shrum, “What Caused the Flood? Controversy and Closure in the Hurricane Katrina Disaster,” *Social Studies of Science* 44, no. 1 (February 1, 2014): 3–33, <https://doi.org/10.1177/0306312713498654>.

<sup>72</sup> R. W. Kates et al., “Reconstruction of New Orleans after Hurricane Katrina: A Research Perspective,” *Proceedings of the National Academy of Sciences* 103, no. 40 (October 3, 2006): 14653–60, <https://doi.org/10.1073/pnas.0605726103>.

<sup>73</sup> Willingham, “The U.S. Moves towards More Integrative Approaches to Water Resources Management, 1970-2010,” 330.

the Corps of Engineers and the local levee boards, in an attempt to cut costs, as the primary cause of the disaster.<sup>74</sup>

Craig Colten, in his environmental history of the Crescent City, argues that suburbanization and the large-scale structural flood protection infrastructure built to protect New Orleans in the 1960s created a strong path-dependency; a set of investments constrained alternative approaches such as protecting wetlands and increasing urban density.<sup>75</sup> Today, an emerging wider definition of infrastructure would include both natural barriers like wetlands, as well as the navigation channels that destroyed them.<sup>76</sup>

The flood control projects in Houston, Miami, and Tampa were built during decades of rapid social change in the South after World War Two. These were the decades of civil rights and the decades of white flight. While flood control certainly supported the patterns of white flight and suburban sprawl in Houston, Miami, and Tampa, attempts to protect those suburban areas did not necessarily increase the vulnerability of poorer African American and Hispanic neighborhoods to flooding. In terms of the traditional vulnerability model, they represent a contrast to New Orleans. Hurricane Katrina revealed the deep inequality and structural vulnerability of the city to a major natural disaster. Infrastructure failed and flooded those low-lying neighborhoods

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<sup>74</sup> Campbell Robertson and John Schwartz, "Decade After Katrina, Pointing Finger More Firmly at Army Corps," *New York Times*, May 23, 2015, <http://www.nytimes.com/2015/05/24/us/decade-after-katrina-pointing-finger-more-firmly-at-army-corps.html>; J. David Rogers et al., "Interaction between the US Army Corps of Engineers and the Orleans Levee Board Preceding the Drainage Canal Wall Failures and Catastrophic Flooding of New Orleans in 2005," *Water Policy* 17, no. 4 (August 2015): 707–23, <https://doi.org/10.2166/wp.2015.077>.

<sup>75</sup> Craig E. Colten, *An Unnatural Metropolis: Wrestling New Orleans from Nature* (Baton Rouge: Louisiana State University Press, 2006).

<sup>76</sup> A. Carse, "Nature as Infrastructure: Making and Managing the Panama Canal Watershed," *Social Studies of Science* 42, no. 4 (April 2, 2012): 539–63, <https://doi.org/10.1177/0306312712440166>.

where the residents were least able to evacuate. Generally, surrounding neighborhoods were on higher ground and had long histories of being more racially and economically exclusive.

In coastal Florida and Texas the case was more complicated. Some of the most well-established elite areas were the most vulnerable to flooding: from the River Oaks neighborhood along Buffalo Bayou in Houston to the Bayshore area along Hillsborough Bay in Tampa. In Houston, Miami, and Tampa, flood control projects were especially important to protecting new, middle-class subdivisions built after World War Two on hazardous, but cheap, land. Meanwhile, some of the most marginalized areas were on the highest ground near the old downtowns. For example, the Jim Crow-era “Colored Town” north of downtown Miami was on the old coastal ridge near the Florida East Coast railroad line. This was some of best-protected land from flooding in Dade County.

N. D. B. Connolly writes in detail about the elite alliances across racial lines that allowed Colored Town to remain extremely segregated well into Miami’s great postwar expansion.<sup>77</sup> Deteriorating housing conditions, a lack of public parks, and new highway overpasses were all hardships for that neighborhood, which remained relatively unaffected by the successful political transformations of the civil rights era. Flooding, however, was not among those hardships. By the 1950s, Connolly points out, there were also a few suburban developments planned for middle-class black families. These developments, as with most of the middle-class housing for whites built after the war, were in areas protected by the major South Florida flood control projects.<sup>78</sup>

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<sup>77</sup> Connolly, *A World More Concrete: Real Estate and the Remaking of Jim Crow South Florida*.

<sup>78</sup> Connolly, 244.

In Houston the situation was similarly complicated. Some older African American neighborhoods, such as the Fourth Ward “Freedmen’s Town” just west of downtown, were flooded extensively in 1935. The area began to decline after 1940 because of the expansion of the downtown business and government center and the construction of highways through the neighborhood.<sup>79</sup> But other areas with growing black populations, such as the Third Ward south of downtown, were on higher ground. After the war Houston’s black population expanded farther south into suburban areas where flooding on Brays and Greens Bayous was more problematic. Meanwhile, toxic air pollution from refineries and chemical production facilities along the ship channel has been a perennial concern of social justice activists in minority neighborhoods on the east side of the city. It is now clear that climate change will exacerbate the impacts of pollution, flooding, and heat stress on those who are the least able to adapt to it in the Houston area.<sup>80</sup>

Today, Houston, Miami, and Tampa all face the threat of stronger storms and higher tides, and contrasting levels of social vulnerability will likely become more stark. These cities will have to make choices about which areas to further protect from flooding. It is unclear whether or not lower-income areas will be protected along with the most expensive real estate.<sup>81</sup> Widespread recognition of which areas routinely flood and which

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<sup>79</sup> Cary D Wintz, “Fourth Ward, Houston,” *The Handbook of Texas Online*, June 12, 2010, <https://tshaonline.org/handbook/online/articles/hpf01>.

<sup>80</sup> Yamiche Alcindor, “In Sweltering South, Climate Change Is Now a Workplace Hazard,” *The New York Times*, August 3, 2017, sec. Politics, <https://www.nytimes.com/2017/08/03/us/politics/climate-change-trump-working-poor-activists.html>.

<sup>81</sup> Natalie Delgadillo, “The Realities of Sea-Level Rise in Miami’s Low-Income Communities,” *CityLab*, October 23, 2016, <http://www.citylab.com/weather/2016/10/sea-level-rise-is-affecting-miami-low-income-communities/505109/>.

areas are on the high-ground might also lead to rapid gentrification of those better protected areas.

### **Overview of the following chapters**

The following chapters develop and compare the case studies for Houston, Miami, and Tampa over five decades. Chapter Two considers local, state, and federal responses to Houston's catastrophic flood of 1935. It set a pattern of creating a state institution to manage regional flood control, secure federal funding, and attempt to complete a system of protective infrastructure. World War Two proved both a delay – and later a justification – for completing Houston's main flood control project. The chapter ends with a decade of civic frustration as county leaders tried, and only partially succeeded, to extend flood control projects to protect new suburban development in the 1950s. For this account, I relied heavily on comprehensive newspaper files collected by a longtime commissioner for Harris County.

Chapter Three moves to South Florida and the sweeping, regional flood of 1947. The system built to protect cities like Miami and Fort Lauderdale from future floods was enormous, and there has been a great deal of previous scholarship on its environmental impacts. I build the Miami case study around that earlier research, but I try to shift the focus towards the concerns of the metropolitan area which were often different from the farmers and conservationists in the Everglades. The chapter follows the Central and Southern Florida Project from its authorization through its first two phases, which were mostly complete by the late 1960s. Growing environmental concerns stalled several key extensions of the system in the 1970s.

Chapter Four looks at the rural Southwest Florida Water Management District surrounding Tampa, and its responses to the major flood of 1960, as well as the years of

severe drought that followed. Very few elements of Tampa's federal project, called the Four River Basins, were ever completed. But the approaches to flood control used by the Water Management District adapted to the reality of carrying out its mission in the budget-constrained 1970s under increasing environmental regulations. For this chapter, I was lucky to find several excellent oral histories that I use to show this change of approach from the perspective of the Water Management District's leadership.

Chapter Five compares the impacts of the local environmental movement on all three sites. Along with budget constraints, grassroots environmental activism – aligned with national attention on issues of ecosystem damage, water quality, and natural beauty– led to significant modifications of the plans for flood control in each city. Generally, this period began in the late 1960s and continued until the early 1980s. University libraries in each city have archived the papers of key activists and organizations, and these environmental collections proved invaluable for this comparison.

Chapter Six attempts to draw out a variety of patterns and comparisons across the cases. Given these different cities and the decades in which their flood control projects started, I try to give some preliminary answers to the essential historical questions of what changed over time and what stayed the same. I am also particularly interested in how the story of flood control in each city is continuing today as these coastal sites start to increasingly feel the impacts of climate change.

Finally, I want to highlight the appendix on coastal engineering. Houston, Miami, and Tampa are all coastal cities, and much of their development was oriented towards the waterfront. Coastal engineering activities gave the cities access to the beaches and waterways that were so crucial to their development. It also reflects the impact of the

environmental movement and the paradigmatic shift in engineering practice away from big infrastructure and towards non-structural approaches. While coastal engineering was not essential to the inland flood control systems that protected each city in the postwar period, it did clearly impact historic patterns of development.

## CHAPTER 2

### CIVIC FLOOD CONTROL IN HOUSTON, 1935-1956

On December 10, 1935, downtown Houston was underwater. Over the previous three days more than 20 inches of rain had fallen in Harris County, and Buffalo Bayou had risen 45 feet to reach a peak flood stage at more than 40 feet above sea level at Main Street on December 9.<sup>82</sup> Lives were lost, and damage to the city was widespread. Six children and two adults drowned as flash flooding tore them from downtown bridges, warehouses and commercial buildings near Buffalo Bayou were completely destroyed, and over 100 residential blocks were flooded.<sup>83</sup> Fires broke out in some of the damaged buildings, and firefighters, contending with poor access on flooded streets and broken waterlines, struggled to contain the blazes. All but one of the seventeen railroads serving the city of Houston were cut off. Out of fourteen bridges crossing Buffalo Bayou in the city, ten were underwater.<sup>84</sup> At the time, damages were estimated at \$2.5 million (about \$45 million in 2016 dollars).

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<sup>82</sup> Tate Dalrymple, "Major Texas Floods of 1935" (US Department of the Interior; US GPO, 1939), 282, <https://pubs.usgs.gov/wsp/0796g/report.pdf>.

<sup>83</sup> Dalrymple, 276.

<sup>84</sup> Robert J. Cummins, "Letter to Captain WH Smith, Facilities Review Committee," February 19, 1943, Auditors 395.19, Harris County Archives.





*Figure 2.1 Buffalo Bayou near Main Street, 1935. Houston Chronicle. Harris County Archives*

As floodwaters began to recede over the next few days, over 2 million cubic yards of debris, trash, and silt continued to block access to the Port of Houston and the upper reaches of the Houston Ship Channel connecting the city with the Gulf of Mexico.<sup>85</sup> Houston's main sewage treatment station was inundated and shutdown. The city was forced to dump half its untreated sewage directly into the ship channel. The port was closed entirely for ten days, and the U.S. Army Corps of Engineers spent the next eight months clearing silt, mud, and debris from the ship channel.

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<sup>85</sup> J. Russell Wait, "Letter to George D. Suter," June 1, 1936, J. Russell Wait Port of Houston Collection, Box 8, Woodson Research Center, Rice University.

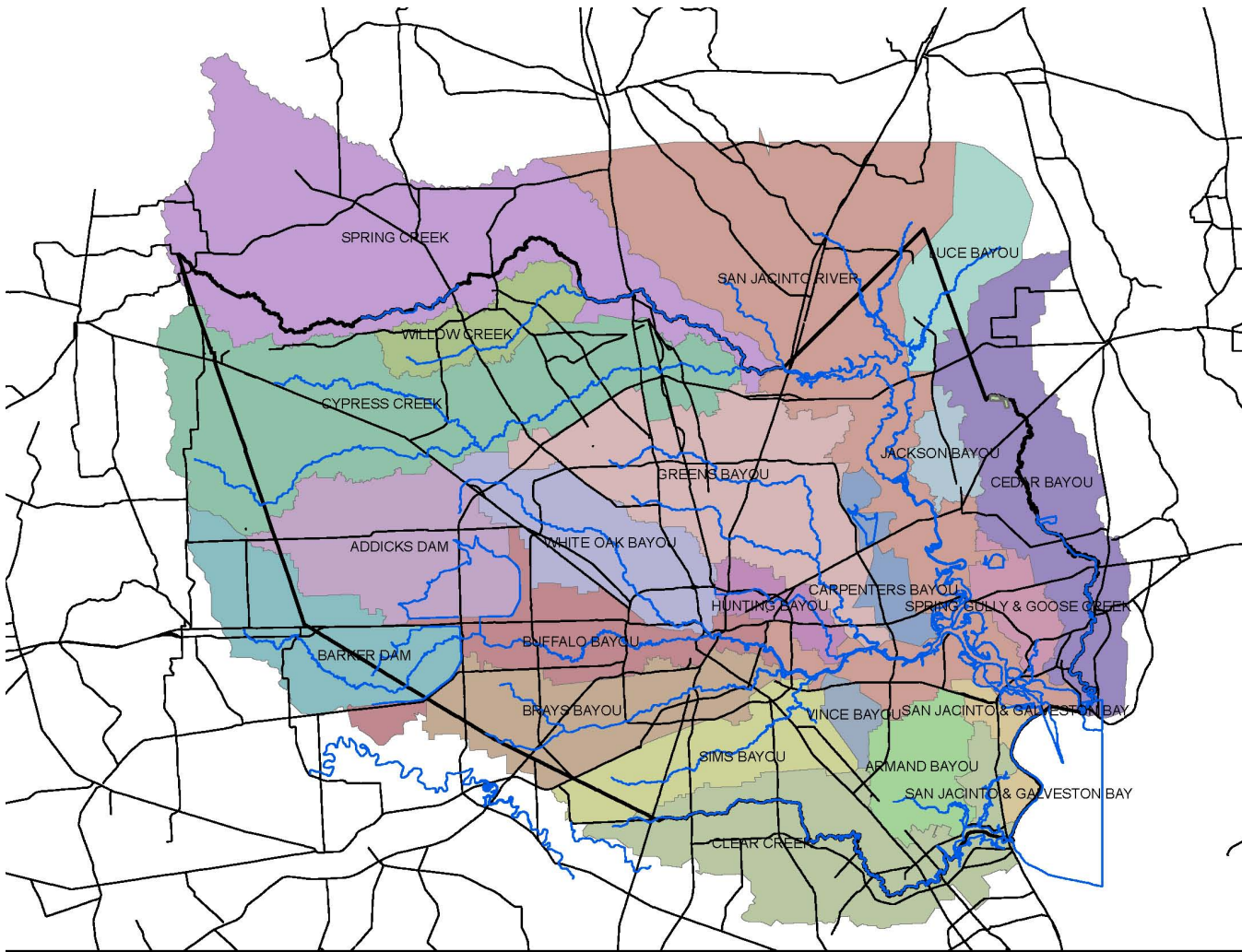


Figure 2.2 Map of Houston's bayou watersheds, 2011. Bayou Preservation Association.  
<http://www.bayoupreservation.org/Bayous>

Houston had been founded on the banks of Buffalo Bayou less than a hundred years previously. At that time Buffalo Bayou was a shallow, muddy creek only big enough for barges to bring cotton down to Galveston.<sup>86</sup> Houston's Harris County was famed for its mud and its meandering watercourses that had required decades of small

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<sup>86</sup> Earle B. Young, *Galveston and the Great West*, 1st ed, The Centennial Series of the Association of Former Students, Texas A&M University, no. 69 (College Station: Texas A&M University Press, 1997), 4.

drainage projects to clear for the development of towns.<sup>87</sup> The Houston Ship Channel had been carved out of the San Jacinto River and lower Buffalo Bayou by the Corps of Engineers between 1910 and 1914, and over the next 20 years Houston had grown to far surpass its regional rival, Galveston, as Texas' key deepwater port. In fact, in 1935, Houston was the second largest port in the country in terms of total tonnage.<sup>88</sup>

With its new ship channel, Houston was supposed to have been a "protected port" while Galveston was acutely vulnerable to hurricanes. Situated on a barrier island in the Gulf of Mexico, Galveston had been almost completely destroyed by a hurricane in September 1900. After the storm, Houston, via the State of Texas, had petitioned Congress for funding to dredge the ship channel so that the region could have another, safer port. Part of Houston's success in becoming the commercial center of the Southwest had been because its location was less vulnerable to storms, but more importantly it offered easy access to cross-country rail lines, and with great fortune had been situated near major oil discoveries on the Louisiana border. In 1935, Houston was still a "Bayou City" with sandy soils and many creeks draining into the gulf.<sup>89</sup> Annual rainfall in the Houston area was on average 50 inches, and significant flooding from "cloudbursts" –

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<sup>87</sup> Dylan Baddour, "The Trouble with Living in a Swamp: Houston Floods Explained," *Houston Chronicle*, May 31, 2016, <http://www.houstonchronicle.com/local/explainer/article/The-trouble-with-living-in-a-swamp-Houston-7954514.php>.

<sup>88</sup> General J. L. Schley, "Hearing before the House Committee on Rivers and Harbors on Improvement of the Houston Ship Channel and Buffalo Bayou, Tex.," § US House of Representatives, Committee on Rivers and Harbors (1938), <https://scholarship.rice.edu/bitstream/handle/1911/37932/wrc00070.pdf>. Major General Julian Schley had become Chief of Engineers in October, 1937. He had earlier been the District Engineer in Galveston, among other positions in the Corps.

<sup>89</sup> Joseph A. Pratt, "A Mixed Blessing: Energy, Economic Growth, and Houston's Environment," in *Energy Metropolis: An Environmental History of Houston and the Gulf Coast*, ed. Martin V. Melosi and Joseph A. Pratt, History of the Urban Environment (Pittsburgh, Pa: University of Pittsburgh Press, 2007).

where torrential amounts of rain could fall into a single drainage basin over the course of a day – was a constant concern.<sup>90</sup> The 20-year-old deepwater port just east of downtown Houston had been closed a few times previously due to floods, most spectacularly only six years earlier when parts of the city’s commercial center had again been underwater.<sup>91</sup> The director of the Port of Houston, J. Russell Wait, claimed that episodes like this made it impossible for ships to travel down the channel, and these disruptions to shipping were being exploited by competing ports who claimed to have more reliable conditions in their harbors.<sup>92</sup> Development of the southeast Texas region as a whole was being hindered by the recurrent flooding. As a front-page editorial in the *Houston Chronicle* extolled the day after the flood waters peaked,

“We must not forget this tragedy as we did the one in 1929. Houston has been visited by four serious floods in the last 40 years, each worse than the preceding one... This county simply can not now be drained by that little stream reaching from the Farmer's Market through the jumble of buildings and beneath low bridges to the Main Street Viaduct. Nor can it be drained by the winding, undeeened bayou leading from Main Street to the Turning Basin.”<sup>93</sup>

To protect Texas’ largest port and the commercial center of downtown Houston there was growing determination for permanent, transformative flood control. After the shocking aftermath of the 1900 Galveston hurricane, the Corps of Engineers had built a massive

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<sup>90</sup> Dalrymple, “Major Texas Floods of 1935,” 224.

<sup>91</sup> Harris County Flood Control District, “‘Wild River’: A Pictorial Petition Presented to the State Affairs Committees of the 45th Legislature,” March 4, 1937, [https://www.hcfcd.org/media/1345/wildriver1937\\_hcfcd\\_created.pdf](https://www.hcfcd.org/media/1345/wildriver1937_hcfcd_created.pdf).

<sup>92</sup> Wait, “Letter to George D. Suter.”

<sup>93</sup> J. R. Gonzales, “Houston’s Devastating Flood of 1935,” *Houston Chronicle*, accessed October 16, 2015, <http://www.houstonchronicle.com/local/bayou-city-history/article/Houston-s-devastating-flood-of-1935-6293100.php>.

seawall to protect that city from future storms.<sup>94</sup> In 1935, the question loomed large – how would Houston be protected from future floods?

### **Securing federal funding for flood control**

The year 1935 had been a devastating one for flooding throughout Texas, with major damage in May and June in the cities of Austin and San Antonio and to nearby farms and ranches along the Colorado and Nueces rivers.<sup>95</sup> As the year came to an end and yet another wave of floodwaters were still subsiding in Houston, the city's civic leaders formed a Navigation and Flood Control Committee to find more permanent solutions to the recurring floods.<sup>96</sup> The committee consisted of county officials, such as Harris County judge Roy Hofheinz and director of the Port of Houston, Russell Wait. There were also engineers who volunteered as consultants to the committee, such as Robert Cummins, who had formerly been in charge of a local drainage district and whose construction firm had built several facilities at the Port of Houston.

The committee was chaired by Harry Washburn who was the Harris County auditor. He was a natural choice, since he had also been the auditor for the Port Commission and several area drainage districts.<sup>97</sup> Washburn's extraordinary commitment to financial discipline and public service to the Houston area had started before World War I. He would continue serving the county well into the late 1940s. Washburn did not believe in using municipal debt to pay for anything but capital projects, and he was

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<sup>94</sup> Albert B. Davis, "History of the Galveston Sea Wall," in *Proceedings of Second Conference on Coastal Engineering: Houston, Texas, November 1951* (The Engineering Foundation, Council on Wave Research, 1952), 268–80.

<sup>95</sup> Dalrymple, "Major Texas Floods of 1935," 223.

<sup>96</sup> Wait, "Letter to George D. Suter."

<sup>97</sup> "Washburn Reappointed," *Houston Post*, April 10, 1943, Squatty Lyons Papers, 1943, Harris County Archives.

especially proud of putting Harris County on a “cash basis,” paying for services with money already collected.<sup>98</sup> Even during the worst years of the Great Depression, Washburn had kept Harris County mostly away from new debt. He was proud that the value of Harris County’s bonds had increased, and he was not going to let new projects overextend that legacy. After Houston’s first catastrophic floods in 1929, Washburn had called for supporting larger flood control projects at the county level. The county’s ten drainage districts were financially sound but not capable of taking on debt to pay for larger-scale projects. If flood control was going to succeed at the scale it needed to be to protect the city as a whole, under Washburn’s watch, there needed to be one institution raising money for flood control, and he needed to find funders beyond Harris County.

Starting in early 1936, the Corps of Engineers made early assessments of what a more effective flood control system would look like in the Houston area. One early and fairly inexpensive idea was simply to widen the channel of Buffalo Bayou through the city, straighten out bends, and clear away any obstructions. The bayou would then be able to handle larger floods, and flooding downtown would be more limited, but the excess volume of water dumped down the ship channel would still make navigation impossible. Russell Wait, who had become director of the Port of Houston in 1930, was immediately concerned that these initial plans would put the city ahead of the port. Wait championed the creation of a new flood control district that could speak equally for the interests of the Port of Houston as well as the city itself.

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<sup>98</sup> Harry L Washburn, “Harris County Auditor’s Report, 1930” (Harris County, December 1930), University of Houston Libraries.



Figure 2.3 Pamphlet "Wild River", 1937. Harris County Flood Control District.  
[https://www.hcfcd.org/media/1345/wildriver1937\\_hcfcd\\_created.pdf](https://www.hcfcd.org/media/1345/wildriver1937_hcfcd_created.pdf)

The Harris County Flood Control District (HCFCD) was authorized by the Texas legislature in 1937. Since the Port of Houston and the ship channel had been blocked for so long by the floods of 1935, and federal projects were still justified primarily as improvements to navigation, the flood control district's primary mission was first to protect the port of Houston. A secondary goal was to protect property in the city of Houston itself, and the last priority was to prevent flooding in rural, unincorporated areas of Harris County. This last mission had been the purpose of the county's drainage districts. The HCFCD was not Texas' first flood control district, but it was the first to be

limited to only one county and essentially serve only one major city. Convincing Texas state legislators to approve the creation of the flood control district – an expansion of government that would primarily benefit only the city of Houston and its port especially – required some campaigning. A pamphlet entitled “Wild River” showed downtown Houston inundated at the height of the flood. Materials like this were brought to the state legislature and printed in newspapers throughout Texas.<sup>99</sup> They reminded Texas voters and their representatives that Houston had become the main port of embarkation for goods from the entire state and that disruptions to commerce in Houston affected farmers throughout the Southwest.

Regional flood control was not, however, new. Large federal hydroelectric projects had been initiated on the Colorado River in the area around Austin only a few years previously.<sup>100</sup> The floods of 1935 had also been very damaging to rural areas in central Texas, and flood control soon became part of the multipurpose mission of the Lower Colorado River Authority (LCRA). A young Congressman Lyndon Johnson had been particularly influential in bringing this kind of federal intervention, modeled on the Tennessee Valley Authority (TVA), to central Texas.

The LCRA was clearly a New Deal precedent for the flood control works in Houston, but hydroelectric power was not appropriate for Harris County’s sluggish bayous. Both projects did eventually share the goal of federal intervention in water systems to boost industrial development, but civic leaders in the city never mentioned the ongoing projects less than a hundred and fifty miles away. While there had been many

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<sup>99</sup> Harris County Flood Control District, “Wild River.”

<sup>100</sup> Phillips, *This Land, This Nation*, 160.



rural drainage districts organized previously in Harris County for the purposes of agricultural conservation and land reclamation, the HCFCD would be a new state agency with additional powers to contract with the federal government and raise funds specifically for flood control infrastructure.<sup>101</sup>

The Harris County Flood Control District was supposed to coordinate a range of flood control projects in Houston and Harris County and maintain infrastructure in the long term – adding to fears that it would eventually supersede older, locally-controlled drainage districts. It was a single agency to represent all the interests of Harris County and ensure financing for local contributions to federally sponsored dam and reservoir projects. Only with legislative and voter approval would the HCFCD be empowered to sell bonds, incur debt, and raise taxes to pay for the county's share of the flood control infrastructure.

With the HCFCD successfully in place, the next step for the county's Navigation and Flood Control Committee was to secure the maximum amount of federal funds for flood control projects. Flood control on Houston's Buffalo Bayou was justified by its benefits to the Port of Houston, and thus it fit with one of the primary missions of the Corps of Engineers to improve navigation. Clearly the city would also be protected.

The Flood Control Act of 1936 allowed for the calculation of economic "benefits" to justify flood control projects to include potential development in the region. Although improvements to navigation on the ship channel were the first justification for federal funding, the total benefits in this case were calculated by the potential damages to

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<sup>101</sup> Earnest A Knipp, "Letter to HL Washburn, Harris County Auditor," July 27, 1938, Auditors Papers - Flood Control, Harris County Archives.

businesses and homes from future floods that could be avoided by each project. This wider calculation of benefits “to whomsoever they may accrue” to justify the costs of flood control projects was an expansion of the federal role. It allowed the Corps of Engineers to build infrastructure that protected property along rivers, as long as there were “local contributions”.<sup>102</sup> Some of these local contributions could be money spent directly on related flood control projects, but more often they involved municipalities and counties giving rights-of-way for building dams, levees, and reservoirs. The 1936 Flood Control Act also mandated that localities absolve the federal government from damages resulting from the flood control works.

Houston Congressman Albert Thomas and Major General J. L. Schley, the Army’s Chief of Engineers, testified before the House Committee on Rivers and Harbors in January 1938.<sup>103</sup> Representative Thomas had been particularly enterprising in expanding federal support for these kinds of flood control projects, which had been previously restricted to the Mississippi Delta.<sup>104</sup> As one skeptical committee member concluded the hearing, “You think up some good things so far as the Federal Government is concerned, Mr. Thomas.”<sup>105</sup> At the hearing, Representative Thomas argued for the importance of Houston’s waterborne commerce – to the state of Texas and to the entire Southwest region. He proudly mentioned an article in *Fortune* magazine that noted

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<sup>102</sup> Joseph L. Arnold, *The Evolution of the 1936 Flood Control Act* (Office of History, US Army Corps of Engineers, 1988), 71.

<sup>103</sup> Schley, Hearing before the House Committee on Rivers and Harbors on Improvement of the Houston Ship Channel and Buffalo Bayou, Tex.

<sup>104</sup> James M. Wright, “The Nation’s Responses to Flood Disasters: A Historical Account,” 2000.

<sup>105</sup> Schley, Hearing before the House Committee on Rivers and Harbors on Improvement of the Houston Ship Channel and Buffalo Bayou, Tex., 15.

Houston had rapidly become the second largest port in the nation – all without the geographical advantages of a natural harbor.

General Schley pointed out that the ship channel had to be dredged annually because of the large amounts of silt collecting at the bottom after high water events. Preventing flooding on the bayous would reduce the amount of money the federal government and the Harris County Navigation District spent on maintaining the channel each year.<sup>106</sup> Both the federal government and Harris County had to pay for annual dredging costs, but locating sites for the spoils from dredging was the primary “contribution” of Harris County to keeping the ship channel deep enough for large cargo ships. Schley noted that federal money spent on these navigation projects would also directly benefit the city of Houston by protecting it from severe flooding in the future.

In the case of Houston, as part of its local contribution, the city would give rights-of-way to build a parkway along Buffalo Bayou that would remove homes and businesses from part of the flood zone. The existing road on the south side of the bayou, Buffalo Drive, would be raised up to act as a levee against future floods. It would also be widened into a main thoroughfare that could itself be a space to contain floodwaters.<sup>107</sup> Although this new “Allen Parkway” would be beneficial to the city that had major roadbuilding plans, and some of the Navigation and Flood Control Committee members worried about the HCFCD and the Corps of Engineers essentially getting into the business of road building, it was still included as part of the flood control project because of its structural

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<sup>106</sup> Schley, 5.

<sup>107</sup> Harris County, “Transcript of Report by Mr. Rafferty to the Navigation and Flood Control Committee,” November 15, 1938, Auditors 394.5, Harris County Archives.

purpose. Most importantly, the federal government would not contract with the city separately from the HCFCD, so some items on the agenda for city development, such as parkways along the bayous, became inherently linked to federal flood control.

#### Competing plans: Measuring risk, controlling costs

As director of the Port of Houston, Russell Wait was primarily concerned about protecting the ship channel from future floods, but he was also worried about the publicity of the bottom line price tag for local contributions the Corps of Engineers' flood control projects. A vote on an early bond referendum was scheduled for that summer of 1938. If infrastructure to contain and divert future floodwaters required too great an amount of local financing, Wait was afraid that voters would balk. Most importantly, the federal government had to be shown to be paying the greater part of the costs.<sup>108</sup>

Business leaders and port commissioners supported flood control plans that could divert some water away from Buffalo Bayou, above the city, before it reached the ship channel. The simplest, and least expensive, solution of extending and widening Buffalo Bayou through downtown Houston so that it had more capacity to carry floodwaters had already been rejected because it would making transport on the ship channel unreliable. Simply widening Buffalo Bayou also would not prevent floods on the western edges of the city where future growth was most promising. In order to achieve the dual purpose of flood control and ship channel reliability, the Corps of Engineers proposed three plans: Two involved building systems of dams, detention reservoirs, and levees to contain floodwaters and channel them partially away from the ship channel, and one very

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<sup>108</sup> J. Russell Wait, "Letter to H.L. Washburn," January 27, 1938, J. Russell Wait Port of Houston Collection, Box 8, Woodson Research Center, Rice University.

aggressive plan diverted floods entirely away from the city and proposed excavating a series of large canals that would move floodwaters north and south of Houston and eventually into Galveston Bay. This transformative plan would entirely control the flow of water through Buffalo Bayou and provide the most comprehensive flood control for Harris County. At nearly \$54 million, it was also by far the most expensive plan, and it would require the most local contributions.

The Harris County Navigation and Flood Control Committee preferred a more affordable compromise between all the water going through the city and complete diversion. The \$22 million “Three Corridor Plan” was a scheme that allowed some water to be diverted away from the ship channel through dams and sluiceways, and then the remaining water could move down Buffalo Bayou in a more controlled flow.<sup>109</sup> The first “corridor” was Buffalo Bayou itself, and the other corridors were north and south of the city. Short canals and sluiceways would connect existing drainage features to make the north and south corridors available for floodwaters from a dam above Buffalo Bayou. The Three Corridor Plan was designed by Harris County drainage engineer Jack Rafferty. For it to work, Harris County would have to put up nearly \$10 million – mostly from rights-of-way and other improvements to the stretches of Buffalo Bayou running through the city – and the federal government would pay nearly \$12 million to build the gates, dams, levees, and sluiceways.<sup>110</sup>

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<sup>109</sup> Robert J. Cummins, “Letter to H.L. Washburn Regarding the Three Corridor Plan,” March 3, 1938, Albert Thomas Papers, 9.3, Woodson Research Center, Rice University.

<sup>110</sup> Wait, “Letter to H.L. Washburn.”

Estimates of the scale of flooding, and the amount of rain that would produce that volume of water over a certain period of time, became key points of contention in negotiations between the HCFCD, the city government, and the Port of Houston. For example, the Three Corridor Plan was designed to handle a storm like the one that had caused the 1935 floods, or as county drainage engineer Jack Rafferty explained, “a major portion of the flood waters such as the natural drainage arteries in the county might be called upon to handle in rainfall of 10 inches a day for each of three successive days.” The Three Corridor Plan also represented an early effort to achieve comprehensive flood control for all of Harris County, since it would leave open the possibility of diverting floodwaters from other bayous in the area in the future.

The Corps of Engineers did not fully support the Three Corridor Plan because it did not show enough precaution for the scale of potential flooding in the future. Colonel Frank Besson, the Corps’ district engineer in Galveston, came back to the Navigation and Flood Control Committee with a new diversion plan that could shunt most floodwaters away from Buffalo Bayou.<sup>111</sup> In the event of a flood of even greater proportions than 1935, even more water could be prevented from ever passing into the ship channel and disrupting the port or damaging the city. For the larger scale of these works, the Corps of Engineers estimated the potential for rainfall in the Buffalo Bayou drainage basin exceeding both the 1929 and 1935 floods. They used the greatest recorded rainfall from high up in the Buffalo Bayou drainage basin, an 1899 storm near Hearne, Texas, that dropped 30 inches of rain above the Katy Prairie, and applied that amount to the entire

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<sup>111</sup> Colonel Frank S. Besson, “General Plan of Flood Control, Buffalo Bayou, Texas.,” March 15, 1939, J. Russell Wait Port of Houston Collection, Woodson Research Center, Rice University, <http://hdl.handle.net/1911/37307>.

basin to calculate the maximum potential flood in Houston. It would produce runoff 50 percent greater than the 1935 flood. This was the project “design storm,” or as Colonel Besson told the Navigation and Flood Control Committee a year later, “it is the largest storm that we think can happen in Houston, and if you are going to protect Houston you may as well protect it right.”<sup>112</sup>

Still concerned about the cost of local contributions, Russell Wait shared his frustrations about the Corps’ intense rainfall estimates with Robert Cummins, a structural engineer who was consulting on the Buffalo Bayou project with the Navigation and Flood Control Committee.<sup>113</sup> Cummins was responsible for rectifying differences between the county’s and the Corps of Engineers’ flood control plans. Wait showed some confusion over the rainfall estimates, claiming that the Corps of Engineers was using an estimate of more than 21 inches of rain falling in a hypothetical month, while he had recently presented Colonel Besson with statistics from Houston, going back to 1882, that showed that the monthly maximum was just over 15 inches falling in the city. Furthermore, Wait claimed that the Corps of Engineers was assuming that peak flood stages could happen simultaneously in the multiple bayous that fed into the Houston Ship Channel. Wait argued that these simultaneous peaks had never been observed.

In his letters to Cummins over the next few months, Russell Wait disputed Colonel Besson’s estimates, complaining that the Corps of Engineers had imagined a “deluge” – or a theoretical “superflood.” Wait insisted that the county only needed a

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<sup>112</sup> Harris County, “Transcript of Testimony Taken at the Hearing When the Bypass Plan Was Presented by Colonel Besson to the Navigation and Flood Control Committee,” March 16, 1939, Auditors Papers 394.5, Harris County Archives.

<sup>113</sup> J. Russell Wait, “Letter to R.J. Cummins,” July 19, 1938, J. Russell Wait Port of Houston Collection, Box 8, Woodson Research Center, Rice University.

flood control system based on the largest floods observed in the past. Works to contain floods the size of the 1935 incident would be at a more “sensible” scale that was “within the limits of Houston’s ability to pay.” He wrote, “It seems to us that the Navigation and Flood Control Committee is confronted now with only one problem, namely, a problem of policy. Shall we prepare a flood control plan which will take care of any flood which appears in past records, or shall we prepare for a flood which has never occurred and which may never occur, and at a cost of some twenty million additional dollars?”<sup>114</sup>

#### The challenge of raising local contributions

Six months later, in January 1939, with an early bond referendum scheduled the following month, the question of which plan would finally be implemented had not been fully resolved. Both the “Three Corridor Plan” that Russell Wait and the Navigation and Flood Control Committee had championed and the plan to mostly divert waters from a potential superflood into Galveston Bay, as proposed by the Colonel Besson and Corps of Engineers, were starting to look far too expensive. Congress had limited the federal expenditure to only \$9 million, and Houston leaders were still concerned about the politics of raising funds that would end up being a greater amount than the federal contribution.

The first step to be implemented with these funds was a drainage and clearing project on Buffalo and White Oak Bayous in downtown Houston administered by the Works Progress Administration (WPA). The Harris County Flood Control District’s

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<sup>114</sup> J. Russell Wait, “Letter to RJ Cummins,” July 11, 1938, J. Russell Wait Port of Houston Collection, Box 8, Woodson Research Center, Rice University.



contribution would only be a quarter of the more than \$2 million WPA budget.<sup>115</sup> Men working for the WPA would begin by clearing obstructions at the confluence of Brays Bayou and the ship channel. Next they would build a levee to protect the city's central waterworks. Finally they would begin clearing a park-like area around the confluence of White Oak and Buffalo Bayous, just north of Houston's central commercial district. This park would be designed to flood first after a storm and thus provide some protection to the nearby downtown.



Figure 2.4 Illustration from *The Taxpayer* broadsheet, 1939. J. Russell Wait Port of Houston Collection, Woodson Research Center, Rice University

In February 1939, voters were asked whether or not to approve the first set of bonds to be issued by the HCFCD. Publicity for the first \$500,000 bond issue was a key

<sup>115</sup> "Voters Decide Tomorrow on 'Taxless' Bonds for Flood Control," *The Houston Press*, February 24, 1939, JR Wait Port of Houston Collection, Woodson Research Center, Rice University.

concern for the Navigation and Flood Control Committee.<sup>116</sup> Although the amount was small, even by the standards of the late 1930s, Houston's long tradition of foregoing local taxes in favor of other means of making improvements to city infrastructure was on full display. Groups opposed to the bond issue published an issue of the *The Taxpayer* – a Harris County broadsheet devoted to opposing New Deal reforms – devoted entirely to flood control.<sup>117</sup> It showed both the general confusion about the different flood control plans that had been put forward, and it demonstrated skepticism about the need to raise local contributions to federal projects. Fear that the costs of the projects would soar, and the federal aid diminish, were on the front cover in a screaming headline. "Bond Advocates have not told the whole truth about the bonds. They have endeavored to conceal fact that county will have to vote \$13,000,000 to carry out Rafferty program." Inside was an illustration of a deluge of cash flowing out of Houston's city hall leading to "the greatest flood in the history of Houston."

The Navigation and Flood Control Committee and its allies in the Houston Chamber of Commerce, the local drainage districts, and the county and city government prepared their own media response in support of the bond issue.<sup>118</sup> They secured the support of all three of Houston's major newspapers. Everyone involved knew that this first bond issue for the new flood control district would be followed by a much larger

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<sup>116</sup> Harris County Flood Control District, "Minutes of the Harris County Navigation and Flood Control Committee, Friday December 30, 1938," 1938, J. Russell Wait Port of Houston Collection, Box 9, Woodson Research Center, Rice University.

<sup>117</sup> "Bond Advocates Have Not Told the Whole Truth about the Bonds..." *The Taxpayer*, February 1939, Vol 8, No 1 edition, JR Wait Port of Houston Collection, 8.7, Woodson Research Center, Rice University.

<sup>118</sup> William C. Repass, Gordon Turrentine, and Oveta Culp Hobby, "Newspaper Sub-Committee Report to the Harris County Navigation and Flood Control Commission," December 8, 1938, JR Wait Port of Houston Collection, Woodson Research Center, Rice University.

round of bonds in the future. But advocates of flood control believed that the first round of funding would demonstrate local support and help convince skeptics in the state legislature and Congress. Civic leaders also believed that if they waited to issue the bonds until more federal money was available, local opposition would be more well organized in the future, and only another catastrophic flood would be enough to bring back voter support for the bonds.

In newspaper editorials in favor of the \$500,000 WPA bonds, Harris County voters were reminded repeatedly, if perhaps misleadingly, that approving these bonds would not create county obligations for which additional taxes would have to be raised, nor would the flood control district become a new local authority that would levy its own taxes in the future. The flood control committee recognized that new taxes were especially a concern for property owners who were already paying taxes to local drainage districts and did not want to be “double taxed” for flood control. Although the country was still coming out of the recession of 1937–38, the Houston area was growing and new revenue was reducing past indebtedness for municipal improvements such as sewers, water treatment, roadways, and street lighting.<sup>119</sup> There were also reminders of temporary jobs that the flood control projects would create. The WPA bayou drainage projects would employ more than two thousand workers for 18 months.

Voters approved the first set of bonds for the WPA projects, but the amount of local opposition concerned the Navigation and Flood Control Committee. In order to raise the necessary funds for the larger Corps of Engineers projects that were still needed,

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<sup>119</sup> Harold L. Platt, *City Building in the New South: The Growth of Public Services in Houston, Texas, 1830-1910*, Technology and Urban Growth (Philadelphia: Temple University Press, 1983).

Harris County's representatives in the state legislature pushed to be allowed to use some part of the state property taxes. They wanted the HCFCD to get half of the state ad valorem taxes from Harris County for a period ten years. This bill failed in the statehouse.

With a more limited budget, an "Emergency Bypass Plan" was proposed by Colonel Besson in March 1939.<sup>120</sup> The Corps of Engineers had devised a way to divert floodwaters from Buffalo Bayou above Houston without excavating large spillway channels or canals. Instead, an emergency diversion dam would allow floodwaters to temporarily "pool" and then be released along levee-enhanced watercourses south of the city, creating a slow-moving, natural "floodway" to Galveston Bay, mostly bypassing the ship channel. Colonel Besson believed these more low-profile works would allow the Corps to induce a "non-eroding, low-velocity flow" of floodwaters 35 miles across less-developed rural areas and coastal wetlands.

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<sup>120</sup> Besson, "General Plan of Flood Control, Buffalo Bayou, Texas."

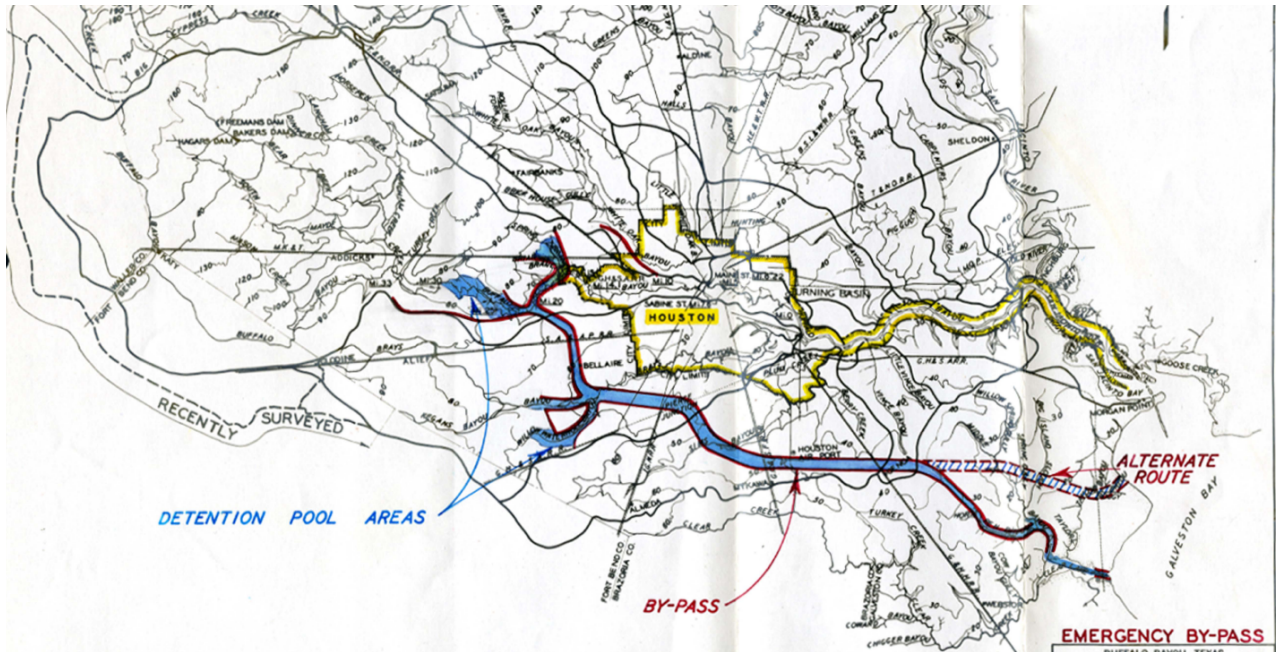


Figure 2.5 Early Sketch of the "Emergency By-Pass Plan", Corps of Engineers, Galveston District, 1939. J. Russell Wait Port of Houston Collection, Woodson Research Center, Rice University

Ultimately a modified version of this plan, combined with elements of the “Three Corridor Plan,” would be approved by Congress in the fall of 1940. It would provide significant protection from the 50-year “superflood” on Buffalo Bayou and thus keep downtown Houston mostly dry and the ship channel consistently operational.<sup>121</sup> But this plan did not provide complete protection against the “design storm,” which would produce volumes of water 50 percent greater than the storms of December 1935.<sup>122</sup> These estimates were eventually standardized into the “standard project flood” that would be used to model future additions to this first round of protective infrastructure.<sup>123</sup>

<sup>121</sup> Colonel Besson did admit that even with the Emergency Bypass system in place the Ship Channel could still see a flood similar to the 1935 storm once every 50 years.

<sup>122</sup> Harris County, “Transcript of Testimony Taken at the Hearing When the Bypass Plan Was Presented by Colonel Besson to the Navigation and Flood Control Committee.”

<sup>123</sup> E.A. Hansen, “Remarks by Colonel E. A. Hansen, District Engineer, Galveston, Before the Flood Control Committee” (Houston Chamber of Commerce, July 26, 1960), Auditors 394.5, Harris County Archives.

The 1940 plan was also designed to prevent some flooding on the other bayous in the Houston area, but it was incomplete and did not anticipate the scale of postwar growth in those areas. The discarded Three Corridor Plan had been designed to prevent floods on White Oak Bayou – another creek of concern since it fed into Buffalo Bayou downtown at Main Street and ran through historic Houston Heights that had flooded in 1935 – but that measure had been deemed too expensive by the Corps of Engineers.<sup>124</sup> With enormous pushback from the Navigation and Flood Control Committee, a small dam was added to the 1940 plans for White Oak Bayou. Brays Bayou, south of the city, was left largely unchecked. There would be no comprehensive flood control for Harris County in 1940. In the final compromise plan the stage was set for the recurrent flooding that would plague Houston in the decades after World War Two as new neighborhoods crowded the banks of White Oak and Brays Bayous which had been left out of the final Corps of Engineers project.

The Definite Project Report for Buffalo Bayou, Texas, submitted by Colonel Frank Besson, was approved by the secretary of the army in October 1940. It called for a system of two dams with large retention ponds on Buffalo Bayou, a smaller dam on White Oak Bayou with its own reservoir, a levee on Cypress Creek to hold back floods on that part of the San Jacinto River, and two canals to shunt flood waters north and south of the city into Galveston Bay. Total costs were nearly \$32 million – \$19 million from the government and \$13 million from Harris County. With voter approval, the HCFCD issued the first bonds for \$3.5 million that same month. The first two projects, Barker and

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<sup>124</sup> Harris County, “Transcript of Testimony Taken at the Hearing When the Bypass Plan Was Presented by Colonel Besson to the Navigation and Flood Control Committee.”



Addicks Dams, were to commence construction in the fall of 1941, but World War Two would both delay, and prove important to, their completion.

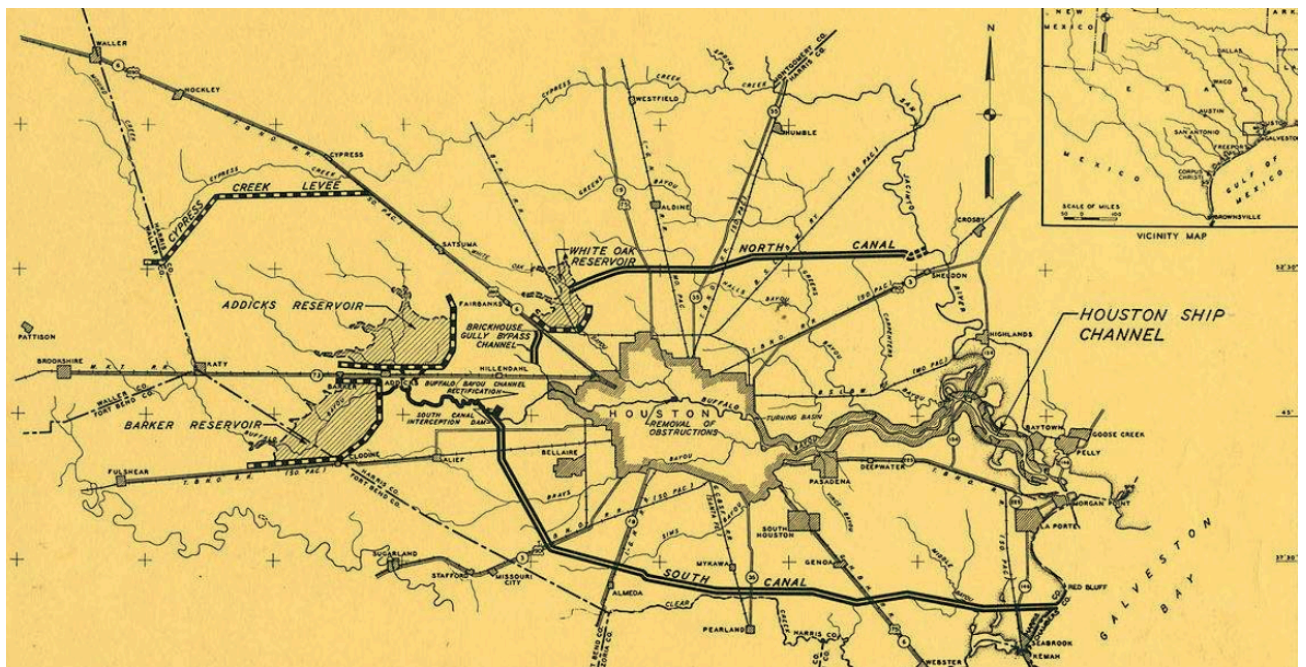


Figure 2.6 USACE Plan of Buffalo Bayou Project, 1940. HCFCF, Harris County Archives. Note north and south canals that were never completed.

### Implementing flood control during World War Two

When the flood control projects in Houston had first been envisioned in the late 1930s they were organized under a New Deal model. There were no hydroelectric dams planned for Buffalo Bayou, but surely the flood control aspects of the TVA and LCRA had been a model for the Harris County Flood Control District. The first local bonds approved in 1939 for clearing Buffalo Bayou had been to contribute to a WPA project. In his first letters to the House Appropriations Committee, Houston Congressman Albert Thomas still used the framing of New Deal arguments to secure funding for flood control in his district. This was similar to the language that had been used to champion the rural TVA six years earlier. Thomas wrote, “Perhaps the greatest economic waste confronting this Country today comes from floods and their companion evils, such as loss of life, loss

of personal property, soil erosion, and, of course, human misery.”<sup>125</sup> The purpose of providing protection for the city of Houston and its vital port industries was very different from rural hydroelectric and flood control systems, and World War Two would provide a better justification for this kind of urban-industrial flood control. As Sarah Phillips argues, large New Deal dams may have started out to restore the prosperity of small-time farmers, but by the late 1930s they had become more oriented towards providing cheap power for regional industrialization.<sup>126</sup> The war would complete this vision as defense industry jobs attracted people from rural areas who could make a better living than in agriculture.

In Houston, defense industries brought new facilities to the ship channel. A large ammunitions depot was located near the mouth of the ship channel at San Jacinto. A tin smelting plant serving the navy was located nearby at Texas City.<sup>127</sup> Shipbuilding facilities were developed, by an offshoot of the construction firm Brown and Root, further inland at the junction of Greens Bayou and the ship channel. By late in the war, the Brown Shipyards were building one destroyer escort a week. More than 20,000 men were employed in those yards.<sup>128</sup> Even more importantly, World War Two brought critical demand for Houston’s oil production and refining.

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<sup>125</sup> Albert Thomas, “Letter to Chairman, House Appropriations Committee,” 1938, Albert Thomas Papers, Woodson Research Center, Rice University.

<sup>126</sup> Phillips, *This Land, This Nation*, 228.

<sup>127</sup> Charles Crotty, “Letter to Albert Thomas,” March 20, 1941, Albert Thomas Papers, 9.6, Woodson Research Center, Rice University.

<sup>128</sup> Robert H Peebles, “Shipbuilding,” *The Handbook of Texas Online*, June 15, 2010, <https://tshaonline.org/handbook/online/articles/ets03>.



Although the Buffalo Bayou flood control projects had been approved by Congress the year before, Houston Representative Albert Thomas again had trouble securing the first large federal payments in both the summers of 1940 and 1941. The economy was still unsteady after large spending programs to drag the country out of recession in 1938 were coming to an end. War had come to Europe, and domestic public works projects were not a top priority in comparison to defense spending.

With America's war looming and defense facilities already being planned along the ship channel, basic improvements to the navigable waterway from Galveston Bay to the Houston Port facilities were starting to compete with the need to start the dams to protect the city. The ship channel needed to be widened, both as a flood control measure and to handle more ship traffic. The navy was particularly concerned about a ship sinking in the channel and blocking badly needed materials from being sent out. President Roosevelt himself weighed in on the issue, blaming the Corps of Engineers for designing a narrow, winding channel that had too many bends and curves to operate at "100 percent efficiency and protection".<sup>129</sup> Nevertheless, the \$5 million needed to start Barker Dam and widen the channel was not made available until the start of 1942, and only after the Harris County Flood Control District loaned the Corps of Engineers \$2.5 million.

In February 1942, construction work finally started on Barker Dam. The massive earthen structure was designed to catch floodwaters flowing off the Katy Prairie – a large area of marshland starting about 35 miles from the city center. At one time this wet prairie, very much like parts of the Florida Everglades, had been much closer to

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<sup>129</sup> Crotty, "Letter to Albert Thomas."

Houston's upscale western suburbs. But earlier drainage projects had allowed some of the city's most expensive neighborhoods, such as River Oaks, to be developed in the 1920s on land that was on newly dry, high ground.<sup>130</sup> Although the wetlands of Katy Prairie had been pushed back, water pooling from those areas after rainstorms was still the main source of intense flooding on the bayous in the city.

Barker Dam looked more like a levee than a dam. It was nearly 14 miles of concrete-reinforced dirt embankment but only 18 feet high. Both Barker and its neighbor to the north, Addicks Dam, still in the planning stages in 1942, would have detention reservoirs behind them, but they would only be filled following flood events on Katy Prairie. Preventing silt from washing into the ship channel far downstream was a secondary purpose of the reservoirs. Water storage was not considered a dual benefit as it would be a decade later in the multipurpose flood control projects in South Florida.

With the construction of Barker Dam much of the wetland sheet flow would be contained well outside the farthest suburbs after severe rainstorms. At full capacity the reservoir could contain 207,000 acre-feet of water. If a storm like the one that brought the 1935 disaster struck again, the peak floodwaters on Buffalo Bayou downtown would be reduced by five feet.<sup>131</sup>

Within a few months, however, the War Production Board shut down work on Barker Dam. Large civil works projects around the country not deemed essential to the war effort were all being paused due to shortages of critical materials and manpower.

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<sup>130</sup> Teresa Tomkins-Walsh, "'To Combine Many and Varied Forces': The Hope of Houston's Environmental Activism, 1923-1999," in *Energy Metropolis: An Environmental History of Houston and the Gulf Coast*, ed. Martin V. Melosi and Joseph A. Pratt, History of the Urban Environment (Pittsburgh, PA: University of Pittsburgh Press, 2007).

<sup>131</sup> Cummins, "Letter to Captain WH Smith, Facilities Review Committee."

Port Director Russell Wait protested the War Production Board's order to the Corps of Engineers. Barker Dam was an earthen structure, and therefore few critical materials were involved. But the shortage of workers could not be denied. Over the next few months, some parts of the project did continue, such as building levees around the reservoir outlets.<sup>132</sup> By late April 1943, the War Production Board had reversed their order and allowed work to continue on Barker Dam partly because Russell Wait had convinced the Corps of Engineers that flooding on the ship channel would directly threaten war industries. Barker Dam would ultimately cost \$2.5 million to complete. Some of the other projects lower on the bayou, such as redesigning downtown bridges to allow more water to flow under them in a flood, had to wait until manpower shortages ended with the war.

#### The beginning of postwar suburban expansion

Meanwhile, in the spring of 1943, even as all-efforts continued in the war in Europe and the Pacific, planning was already underway for a massive program of postwar road expansion. Dallas had already approached the State Highway Commission about permission to build a new kind of high-speed roadway with limited access – Texas' first "freeway."<sup>133</sup> Regional competition between Houston and Dallas was already fierce, and the Houston-Harris County Postwar Highway Planning Committee also sought permission from the state to build a freeway. Texas' first freeway was started in 1946,

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<sup>132</sup> "Report on County Flood Control Work for March Filed," *Houston Press*, April 12, 1943, Squatty Lyons Papers, 1943, Harris County Archives.

<sup>133</sup> Ben Kaplan, "County Committee Maps Road Plans with State Group: Legislation for 'freeways' Asked," *Houston Press*, April 17, 1943, Squatty Lyons Papers, 1943, Harris County Archives.

and it would fully open in 1952.<sup>134</sup> The Gulf Freeway connected Houston to its vanquished regional rival Galveston, now increasingly a weekend getaway from the city.

The plans for road expansion would dwarf the costs of flood control. Over \$125 million was proposed by the Highway Planning Commission in 1943, including new freeways, tunnels under the ship channel, and a complete highway “loop” around Houston. Much of this money would come from the federal government and the state of Texas through an expansion of the Federal-Aid Highway system. The regional roadway network was the basic infrastructure for sprawling postwar development in Harris County. Although the core of Houston and its industrial heart along the ship channel would be protected from flooding, the new suburbs were often planned in low-lying areas that had been only marginally protected by the old agricultural drainage districts. Without any legal authority to control development, the HCFCD was desperate to keep up with the flood control responsibilities created by the new subdivisions.

By the time Barker Dam was nearing completion in the fall of 1944, proposals were already underway for a comprehensive program of flood control for Houston and Harris County that the flood control district engineer, Richard J. Putney, claimed would “almost entirely remove the menace of floods to lives and property.”<sup>135</sup> The proposal would eliminate all the earlier drainage districts and put the HCFCD directly in the Harris County budget. In addition to supplementing the larger federal projects already underway on Buffalo and White Oak bayous, \$9 million in bonds would cover small drainage

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<sup>134</sup> Carolina Gonzales, “Happy Birthday: Gulf Freeway Turns 63 Years Old,” *Houston Chronicle*, accessed September 30, 2016, <http://www.chron.com/chron/tv/this-forgotten-day-in-houston/article/Happy-birthday-Gulf-Freeway-turns-63-years-old-6444307.php>.

<sup>135</sup> “County Bond Issue Would Augment U.S. Flood Plans,” *Houston Chronicle*, October 8, 1944, Squatty Lyons Papers, 1944, Harris County Archives.

projects on all 23 of the watersheds in Harris County. Every bayou – over 900 miles of streams - would be integrated into a network of ditches, culverts, and storm drains in existing and newly developed areas. This was the first comprehensive, county-level flood control program in Texas.

County-wide, comprehensive flood control was only part of the Postwar Planning Committee's \$57 million bond proposal for Harris County. New sewer systems, roads, tunnels under the ship channel, and schools were all under consideration by voters in early 1945. Major Frank Clemens, chairman of the Houston Chamber of Commerce's Flood Control Committee, argued that now was the time to secure Houston's postwar development since after years of deferred projects to the war effort Harris County was "richer than ever."<sup>136</sup> Ad valorem taxes had been reduced for four years straight, and the new bonds would not return them to their prewar level. Another key argument for voters to approve the bonds was that drainage projects and roadbuilding would employ returning soldiers and laid-off workers from shipyards as the war came to an end. In a March 1945 article listing the range of projects planned for the city, *The Houston Chronicle* championed the employment role of postwar construction: "The construction business here after the war is expected to enjoy its greatest period of prosperity and become of the largest industries of this area, furnishing thousands of jobs for returning veterans."<sup>137</sup>

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<sup>136</sup> "Drainage Project to Be Submitted to Harris Voters," *Houston Press*, October 19, 1944, Squatty Lyons Papers, 1944, Harris County Archives.

<sup>137</sup> "Postwar Building," *Houston Chronicle*, March 18, 1945, Squatty Lyons Papers, 1945, Harris County Archives.

# WHY YOU SHOULD VOTE FOR THE COUNTY AND NAVIGATION DISTRICT BONDS

**To assure future progress and development of Harris County which depends on the  
badly needed improvements which the bonds will provide.**

**T**HE \$9,000,000 flood control, \$6,000,000 road, \$2,000,000 courthouse and \$2,000,000 navigation district bonds will mean:

**C**OMPLETE county-wide drainage to prevent the loss of lives and property destruction by disastrous floods.

**M**ODERN roads and right of way for main state highways to be built by state and federal government.

**T**UNNELS under the Ship Channel to speed up traffic and remove the hazards of navigation and make it possible to develop as a whole the North and South sides, now separated by a strip of water.

**A**N adequate courthouse where the public business may be transacted quickly and efficiently with ample storage space for valuable public records and space to make them accessible to the public.

**V**ITAL port improvements necessary for Houston to hold its place as a world port, to meet the competition of key ports in United States. The port which has made Harris County must continue to develop if the vision of a million population in five years is to become a fact.

To give jobs in the postwar era to boys returning from the battle fronts and war workers out of employment during the reconversion.  
To be prepared to co-operate when federal aid is available.  
To make Harris County a better place in which to live.

Passage of all the bond issues is advocated by the Commissioners Court, (County Judge Roy Hofheinz, Commissioners Ruth Turrentine, H. A. May, E. A. Lyons, Jr., Jim Parker and County Judge Elect Glenn Perry and Commissioner Elect Ed Clauder), and approved by the Chamber of Commerce, various civic organizations and all three newspapers.

County Auditor H. L. Washburn, watchdog of the county funds for more than 30 years and friend of the taxpayers, promises that passage of all the bonds will not raise the over-all tax rate during the six-year period more than 12 cents on the \$100 valuation. This is just half of the reductions of 24 cents given the taxpayers in the past seven years.

**Let Harris County GO FORWARD . . .  
VOTE FOR THE COUNTY BONDS**

Figure 2.7. Ads supporting county bonds, 1944. Squatty Lyons Papers. Harris County Archives

Despite the availability of cash from the 1944 bonds and support from Houston's local government and business elite, the vision for comprehensive flood control on all the county's streams would not be implemented until much later. By 1946, Harris County and the federal government had spent a combined \$31 million on flood control projects stemming directly from the 1935 disaster.<sup>138</sup> Barker Dam was completed in February 1945. Addicks Dam was finished three years later. Colonel Frank Besson's plans for the north and south canals were never to see completion, although they had been part of the

<sup>138</sup> J. Russell Wait, "Twenty-Seventh Annual Report of the Director of the Port, Houston, Texas" (Port of Houston, 1946), JR Wait Port of Houston Collection, Woodson Research Center, Rice University.

Corps of Engineers' Definite Project Report in 1940. The costs of buying land became prohibitive as the city pushed outward in the late 1940s. But the two completed dams, with their ability to slowly release flood waters down Buffalo Bayou, were largely successful in preventing the same scale of flooding downtown, and they were even more effective at stopping future disruptions to commerce on the Houston Ship Channel.

With the war over, justifications for new civil works projects were everywhere, and Congress was largely ready to appropriate these funds in order to slow the weaning of wartime expenditures and employ returning servicemen. In late 1945 the Southwestern Division of the Corps of Engineers was waiting for congressional appropriations to begin construction on \$112 million in flood control projects for Texas.<sup>139</sup> According to General E. H. Marks, the Southwestern Division commander, these projects would more than offset the loss of \$25 million in military construction projects that had been canceled by the end of the war.

The scale and expense for flood control projects on the Brazos, Trinity, and Angelina rivers were many times greater than what had been authorized for Houston: \$28 million for a dam and large reservoir on the Brazos River near Waco, and \$22 million for a reservoir on the Angelina River near Nacogdoches. These were large, regional projects compared with the \$4 million authorized for Addicks Dam on Buffalo Bayou that same year. As was the case in Houston, the war had interrupted planned New Deal-era navigation, flood control, and hydroelectric power projects throughout Texas. But in

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<sup>139</sup> Associated Press, "Army Engineers Have Plans for Spending \$112,000,000 on Texas Flood Control," *Galveston Daily News*, August 18, 1945, Squatty Lyons Papers, Harris County Archives.

contrast to Houston, the value of land in rural areas of the state was not increasing dramatically.

The Corps of Engineers was finding a new, significant postwar role that would eventually lead to accusations of self-interest and pork-barrel politics. Certainly some of the projects they proposed for Texas and Florida were on a grand scale. For example, the War Department's \$300 million civil works budget for 1947 included plans to make 300 miles of the Trinity River navigable, from the Gulf of Mexico to Fort Worth, and to cut a barge canal over a hundred miles across north Florida as part of the Intracoastal Waterway.<sup>140</sup> Although neither of these projects would ever see completion, it was a moment when large-scale civil works could still be envisioned and gain support. That same year, widespread flooding in newly-populous South Florida would inspire local officials to demand federal action, and the Corps of Engineers would begin their largest flood control project outside of the Mississippi valley.

In the late 1940s the city of Houston itself was rapidly growing, both in population and in area. Prior to the war, most of the population of Harris County lived inside the city of Houston. Beyond the city limits were a few small towns and large rural areas. Before the war, in 1939, some Harris County residents had vehemently opposed the federal flood control projects because they seemed to benefit the city and port over rural areas.<sup>141</sup> By the end of the war, flood control had become a county-wide project,

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<sup>140</sup> "\$2,200,000 in Flood Work Here Favored," *Houston Chronicle*, February 6, 1946, Squatty Lyons Papers, 1946, Harris County Archives.

<sup>141</sup> Harris County, "Transcript of Report by Mr. Rafferty to the Navigation and Flood Control Committee."



rural areas were disappearing, and the population was shifting outside of the city into new suburbs in unincorporated areas.

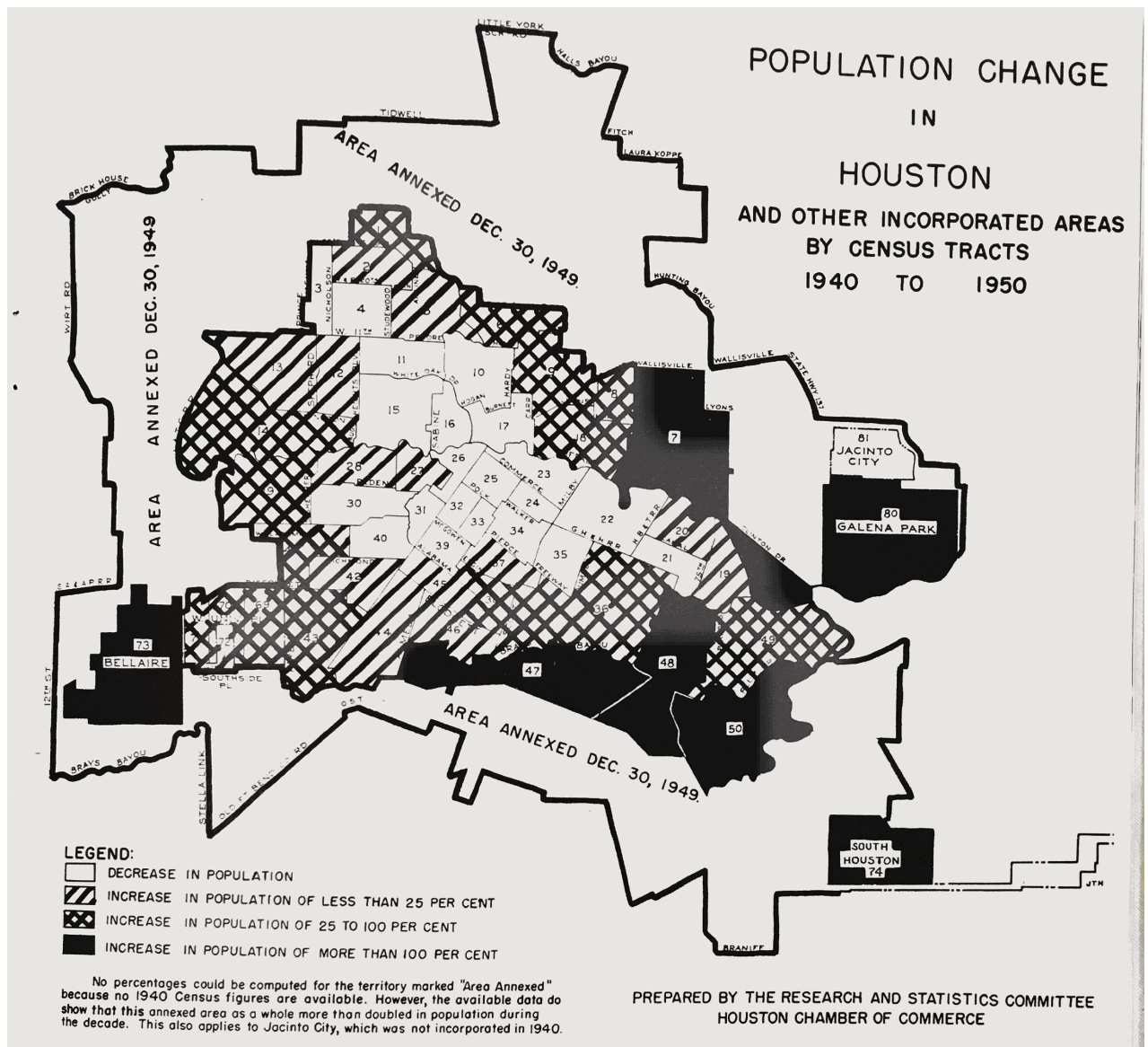


Figure 2.8 Graphic from *Wild River (1951 Reprise)* showing suburban population gains in greater Houston, 1951. Auditor's Papers, Harris County Archives

### The struggle to keep the suburbs dry in the 1950s

In the first years after World War Two, Houston became the fastest growing city in the country. Between 1940 and 1950, the population of Harris County increased by 50 percent to about 810,000 people. During that time, the population of close-in suburban

areas such as the town of Bellaire and the neighborhoods of South Houston, both near to Brays Bayou, doubled. The same explosive growth happened in east side suburban working-class neighborhoods, such as the town of Galena Park, that served the industries along the ship channel. Along with other sunbelt cities, Houston's historic neighborhoods closest to downtown experienced small population losses, a trend that would accelerate during the 1950s.<sup>142</sup>

In 1948 alone property values increased by 13 percent. Harris County's operational budget increased likewise, but it was not enough even to provide services, let alone finance the necessary infrastructure of roadways and sewers, to all the new areas.<sup>143</sup> "The Problems of Growth" suddenly made headlines. Questions remained about whether some new developments outside the city limits should remain in unincorporated Harris County, incorporate into their own cities, or be annexed by the city of Houston.

The new suburbs of the late 1940s were almost entirely unregulated; they did not put in facilities for drainage or sewage treatment, relying instead on septic systems, as was a common practice around the country.<sup>144</sup> Many did not even plan for trash collection. Sometimes they were built far too close to bayou floodplains. In his environmental history of suburban expansion during this period, Adam Rome writes that

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<sup>142</sup> *Texas Almanac and State Industrial Guide* (The Dallas Morning News, 1971). Across the whole State of Texas, the balance between urban and rural populations shifted dramatically between 1940 and 1950. The population of urban places increased by nearly 60% over that decade while the population of rural areas declined by 12%. It was the first Texas census where urban populations exceeded rural ones. Cities like Houston were booming with jobs, and "foreigners" from other states poured in along with many migrants were from rural parts of Texas.

<sup>143</sup> "Harris County's Boom Growth Costs Money," *Houston Chronicle*, 1949, Squatty Lyons Papers, Harris County Archives.

<sup>144</sup> Rome, *The Bulldozer in the Countryside*.

the “construction of homes in flood-prone areas became much more common” after World War Two. He elaborates:

“In some fast-growing regions, the increase was phenomenal. In Denver, the residential acreage in floodplains jumped by 250 percent in the 1960s. In Dallas, the number of single-family homes in the floodplains of the Trinity River rose by 641 percent from 1936 to 1957; in the Pico-Rivera section of Los Angeles, the increase was 867 percent. Though compilers of floodplain statistics focused on construction along major rivers, a few analysts also noted a tremendous increase in building along creeks and streams.”<sup>145</sup>

Although Houston’s flood control projects had achieved their primary goal after World War Two, rapid new development would eventually require expanded flood protection.

The problem was how to pay for it. Increasing property values meant that the cost of rights of way also increased. The cost of securing rights of way for a 30-mile canal was suddenly prohibitively expensive. By 1956 there was growing reluctance on the part of county property owners to approve new bonds to contribute to federal flood control projects, or even simply to improve local drainage. Voters also repeatedly rebuked the county’s attempts to raise money for new roads and to support the deepening of the Houston Ship Channel. Meanwhile, the resurvey process to begin a second phase of the federal projects was lengthy and uncertain. The frustrations of how to protect the new suburbs were in marked contrast with the relative speed and unified determination to start the earlier, pre-war flood control plans.

#### Civic institutions supporting postwar flood control

Houston was filling up Harris County and grabbing land for affordable middle-class suburbs while maintaining a central authority in the form of a city manager.<sup>146</sup>

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<sup>145</sup> Rome, 173.

<sup>146</sup> Melosi and Pratt, “The Energy Capital of the World? Oil-Led Development in Twentieth-Century Houston.”

Although Houston's population was becoming more diverse as the city became firmly established as a regional industrial center, with many new jobs attracting Mexican and African Americans, the annexation program allowed the city to maintain white majority rule well past the era of Jim Crow restrictions. As the city annexed unincorporated areas around it, surrounding towns were pressured to vote for annexation. It was a strategy that would reinforce sprawl well after the end of official segregation two decades later. It was also a strategy that brought the interests of the city of Houston into closer alignment with Harris County. This pattern of annexation was similar to some sunbelt cities, such as Phoenix, but quite different from the fragmentation that occurred in others, such the Atlanta region.<sup>147</sup> The piecemeal annexation strategy also did not push jurisdictional integration to the same extent as the metropolitan form of government that was established during this same period in "Miami-Dade" County.<sup>148</sup>

After World War Two, county road construction and flood control became tied together, at least in the way in which they were presented to voters on bond referendums. At first county leaders were forcefully optimistic that superhighways and comprehensive flood control could solve the traffic and flooding problems permanently. As in the case of Miami and Tampa later there was still a short-sightedness about the consequences of rapid, sprawling growth. Houston's heavily promoted super-highway "loop" would

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<sup>147</sup> Hardy, "Policy Drought: Water Resource Management, Urban Growth, and Technological Solutions in Post-World War II Atlanta," 5.

<sup>148</sup> "Study Group for City-County Merger Plan Wins Approval," *Houston Chronicle*, May 11, 1955, Squatty Lyons Papers, 1955, Harris County Archives. There were several serious proposals during this period to actually merge Houston and Harris County government functions, but the metropolitan form of government never was approved. Long-time county auditor Harry Washburn claimed that inevitably "the people are going to demand complete consolidation, as a matter of economy and better government." Houston came to dominate Harris County, but small cities and the remaining rural areas sought to maintain as independent as possible.

become a traffic-clogged inner ring as suburbs grew rapidly past it, and continued development in floodplains would ensure that there was always at least a couple flooded subdivisions to make the local news.

The aspiration of comprehensive flood control for Houston was institutionalized through the array of agencies involved. First, the Harris County Flood Control District responded to urgent needs as flooding continued in new neighborhoods that had not been affected, or had not even existed, when the first round of federal projects was designed in 1939. The HCFCD hired consultants to study the economic impact of these recurrent floods and produced a report claiming that damages were \$5 million annually.<sup>149</sup> Second, numerous civil lawsuits involving property disputes with the HCFCD led to the creation of the office of Harris County Attorney. These cases would no longer be handled through a firm with a private contract with the county but through an elected position.<sup>150</sup> Third, funding the maintenance of flood control systems became easier, although new construction remained a persistent challenge: While the HCFCD had failed to get tax remission from the state in 1939, in 1950 the Texas legislature canceled state property taxes and allowed individual counties instead to raise ad valorem taxes up to 30 cents for every \$100. There were only two uses permitted for these new taxes: farm-to-market roads and flood control.

Finally in the late 1940s, the Houston Chamber of Commerce established a standing committee to fulfill its “civic responsibility” to ensure continued progress on

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<sup>149</sup> Robert J. Cummins, “Letter to Houston Chamber of Commerce Executive Committee,” July 11, 1951, Auditors Papers, Harris County Archives.

<sup>150</sup> Harris County, “Origins of the Harris County Attorney’s Office,” accessed August 9, 2016, <http://www.harriscountytexas.gov/CmpDocuments/90/Internships/History%20of%20Harris%20County%20Attorney.pdf>.

flood control projects that were “essential to the continued and healthy growth of Houston.”<sup>151</sup> This committee was chaired by key business leaders, often ones versed in construction or related industries. County commissioners often attended these meetings. The Flood Control Committee of the Houston Chamber of Commerce continued to lobby for the passage of local bonds and for federal authorization to ensure the completion of comprehensive flood control in Harris County. The chamber of commerce, through research, hearings, and lobbying, was particularly instrumental in providing economic justifications for further federal support, although it was the official policy of the chamber not to request funding appropriations from Congress. This ambivalence was a key political strategy for civic organizations in the increasingly Washington-wary postwar South, and it was a common role for chambers of commerce in rapidly-developing areas such as Los Angeles.<sup>152</sup> For the next two decades, Houston became famous for resisting regulation across every domain, from city zoning to controlling water pollution, while simultaneously celebrating large federal investments such as the Johnson Space Center.

In prosperous postwar Houston county bonds at first seemed like a good solution to twin forms of congested infrastructure – the flow of water and cars through the expanding city – but as voter trust eroded, land values increased, and federal funds lagged behind, road and flood control projects were continually delayed. By the end of the decade, the federal government would solve the road problem by providing funds to

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<sup>151</sup> Houston Chamber of Commerce, “Minutes of the Flood Control Committee,” February 4, 1953, Harris County Archives.

<sup>152</sup> Elkind, *How Local Politics Shape Federal Policy*, 102.

acquire rights-of-way for state and federal interstate highways. The flood control system in Harris County, however, remained perpetually unfinished, and it would soon encounter grassroots opposition from environmental groups who stood behind a different set of values besides expedient drainage. While bayou flooding became a routine occurrence in metropolitan Houston, large, multi-purpose flood control and water supply projects in southeast Texas would move forward on the region's major rivers.

| <b>Referendum year and purpose</b>  | <b>Total amount</b> | <b>Amount for flood control</b> | <b>Approved?</b> |
|---|---------------------|---------------------------------|------------------|
| 1945; completion of 1940 flood control plan                               | \$9 million         | \$9 million                     | Yes              |
| 1950; county roads and drainage   | \$9 million         | \$6 million                     | Yes              |
| 1953; county roads, Port of Houston, and drainage                         | \$39 million        | \$11 million                    | Yes              |
| 1955; county roads and Port of Houston                                    | \$18.5 million      | \$0                             | No               |
| July, 1956; freeway rights-of-way, flood control, juvenile detention home | \$23.5 million      | \$7.5 million                   | No               |
| September, 1956; freeway rights-of-way proposition alone                  | \$15 million        | \$0                             | Yes              |

*Figure 2.9 Harris County Infrastructure Bond Referenda, 1945-1956*

### Responding to floods on Brays Bayou, 1946–1951

In January 1946, flooding on Brays Bayou south of downtown swamped new suburban neighborhoods, overflowed sewers, and raised fears of spreading disease during a polio epidemic in the city. Major medical facilities were themselves in the path of Brays Bayou flooding. Sewage-filled waters threatened Hermann Hospital, Baylor School of Medicine, the M. D. Anderson research hospital, and the land set aside for a “hospital district” that would become the Texas Medical Center. New subdivisions often worked hard to connect to municipal water supplies, but few of them built sewage treatment facilities, and septic systems leaked, or worse, wastewater was sometimes pumped

directly into nearby bayous. Local flooding, contaminated water, and inadequate roads were in the headlines on a regular basis as developers built new neighborhoods in bayou floodplains without any comprehensive planning or county-level oversight.

The floods of 1935 had overwhelmed much of the area of the city between Brays and Buffalo Bayous, and the system of dams and outlets built by the Corps of Engineers did prevent some floodwaters from ever entering Brays Bayou, but it was a secondary concern to the main channel of Buffalo Bayou.<sup>153</sup> In 1946 Barker Dam and its controlled outlets to Buffalo Bayou largely protected downtown Houston and the ship channel, but it did not prevent flooding in neighborhoods only five miles away, such as Braeswood and West University Place. This kind of localized, suburban flooding would set a pattern from which Houston has still not escaped. Subdivision after subdivision, Houston had not anticipated the scale of pent-up, rapid development as the war was coming to an end, and water treatment was particularly inadequate in newly-developed areas. Brays Bayou itself became the main sewer line.

In January 1946, only a couple of weeks after the Brays Bayou flooding, hearings were held by the Corps of Engineers to consider a new round of flood control projects.<sup>154</sup> Along with flood control, public health concerns were a new justification for federal intervention into Houston's drainage problems. The new round of flood control in Houston focused on the "rectification" of the main bayous running through the city. The plan was to straighten and deepen the channels of Buffalo, White Oak, and Brays bayous.

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<sup>153</sup> Harris County, "Transcript of Testimony Taken at the Hearing When the Bypass Plan Was Presented by Colonel Besson to the Navigation and Flood Control Committee."

<sup>154</sup> "Citizens Air Drainage Woes Before Engineers," *Houston Post*, February 1, 1946, Squatty Lyons Papers, 1946, Harris County Archives.



In order to prevent erosion and allow water to drain more rapidly out of the city, the bottom of each bayou would be lined with concrete for several miles in urban neighborhoods.<sup>155</sup> Brush and trees along the banks would be cleared. It was essentially a project to improve drainage instead of to build new structures to contain or divert floods.

The next year, however, the Corps of Engineers returned an unfavorable report on a more extensive solution to the flooding on Brays Bayou. In the summer of 1947, Colonel Henry Hutchings, the Southwestern Division commander, essentially confirmed that the south canal, which had been a key part of the plan for the flood control system in 1940, was never going to be built.<sup>156</sup> There was still some hope that a northern canal could be finished, but the costs were now too high to justify the benefits to Houston's southern suburbs. A planned outlet to divert floods on Brays Bayou into the south canal was now also off the table. Improving drainage on the bayou was going to be the only solution going forward, it would likely cost at least \$10 million, and that work had not been included in the project report in 1940.

So in early January of the following year, 1948, a large delegation of Houston officials and business leaders, including Warren Bellows, one of the area's major builders and the president of the chamber of commerce, went to Washington to get support for hastening drainage work on Brays Bayou.<sup>157</sup> Representatives from the new Texas Medical Center and the Baylor University College of Medicine were especially involved

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<sup>155</sup> Hansen, "Remarks by Colonel E. A. Hansen, District Engineer, Galveston, Before the Flood Control Committee."

<sup>156</sup> Colonel Henry Hutchings Jr, "Notice of Unfavorable Report on Investigations for the Improvement of Brays Bayou," July 28, 1947, Auditors Papers 395.23, Harris County Archives.

<sup>157</sup> Houston Chamber of Commerce, "Minutes of the Flood Control Committee," August 9, 1949, Auditors Papers 394.5, Harris County Archives.

in this appeal as their proposed, \$100 million plans to build south of downtown were threatened by Brays Bayou flooding.<sup>158</sup> On this basis, the Corps' Board of Engineers were receptive to including drainage work on Brays Bayou as part of the Buffalo Bayou project, pending a resurvey.<sup>159</sup> With the completion of Addicks Dam in December 1948, the Buffalo Bayou and Tributaries Project – first studied in 1936, approved in 1938, and started in 1940 – was now operating to prevent flooding on Buffalo Bayou and to protect the Port of Houston. The first phase of flood control was complete, but county leaders were already campaigning for the next one to begin.

In October 1949, the need for a restudy was confirmed by another major flood on Brays Bayou following severe thunderstorms. There were more than five thousand evacuations from neighborhoods and towns along the bayou such as Bellaire, Southern Oaks, and West University Place. Seven hundred blocks of homes, many built in the previous five years, were completely cut off. The main roads leading south of the city were inaccessible for days. All told over 11,000 homes flooded or were surrounded by high water. Direct damages were estimated at \$5 million. After flying over the flooded area, a *Houston Press* reporter wrote that “Homes look like houseboats”.<sup>160</sup>

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<sup>158</sup> Apparently Baylor University had already started building their own levees to protect the College of Medicine and Hospital which had opened in 1947. They were the first buildings in the Texas Medical Center.

<sup>159</sup> “Big Group to Attend Flood Aid Hearing,” *Houston Chronicle*, January 7, 1948, Woodson Research Center, Rice University, <http://hdl.handle.net/1911/37531>.

<sup>160</sup> Elton Whisenhunt, “More Rain Forecast; Flood Damages Thousands of Homes,” *Houston Press*, October 8, 1949.



*Figure 2.10 Aerial view of flooding in new subdivision in Bellaire, Southwest Houston, 1949. Wild River (1951). Auditor's Papers, Harris County Archives.*

Within a couple of weeks, the Board of Engineers for Rivers and Harbors gave a favorable report for the resurvey of the Buffalo Bayou and Tributaries Project, focusing on protecting new development in the area of Brays and White Oak bayous. The resurvey was supposed to be complete by 1951. But with two significant floods in the same area over a three-year period, county officials had to take some immediate action.

The Commissioners' Court authorized the HCFCD engineer, Richard Putney, to go ahead with \$2 million worth of brush clearing and widening work on Brays, White Oak, and Greens bayous. A \$9 million bond vote was scheduled for early the following year. That money would have to go towards acquiring rights-of-way, since property values were steadily increasing despite the repeated flooding. Meanwhile, with the country in recession, appropriations for the Corps' resurvey were uncertain, and Harris County had to loan the Corps funds to begin the process. Congressman Albert Thomas,

who had been so involved in the start of flood control in Houston a decade earlier, made this much smaller deal in the hopes that it would be the beginning of another major project.

In late January 1950, the county held the scheduled vote on the \$9 million bond issue. It included funds for flood control, county roads, completion of a vehicle tunnel under the ship channel, a public “charity” hospital at the new Texas Medical Center, and a new city police headquarters and jail. Only property owners who had paid their poll-taxes in the previous year were eligible to vote, and not many of them did. There were only 14,000 votes cast, but all the measures passed. In contrast to the conflicting urban and rural interests that had clashed around bond referendums before the war, it was clear that rural Harris County was disappearing in the late 1940s, and suburban voters were a growing political force. As a *Houston Chronicle* editorial declared in full booster voice, “The city and rural folks have become so mixed that it is impossible to say where city interests and rural interests have a dividing line.”<sup>161</sup>

With the money in hand, HCFCD hired a full-time civil engineer, H. R. Norman, who had been working in the Corps’ Galveston District office, to coordinate the restudy of the Buffalo Bayou project. Because the original project essentially ignored flooding on Brays and Greens bayous, Norman estimated that thirty miles of rectification through suburban land would now cost at least \$50 million – a stunning figure when the entire original project had come in under \$40 million a decade earlier. “You can’t play with one

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<sup>161</sup> “Our City,” *Houston Chronicle*, January 25, 1949, Squatty Lyons Papers, Harris County Archives.

faucet and let the other faucets run on,” Norman justified. “Brays Bayou is especially important.”<sup>162</sup>

A couple of months later, county commissioners were becoming increasingly frustrated with the delays in clearing Brays Bayou and the spiraling cost estimates coming out of the project restudy. In March, after a public argument with one county commissioner, Harris County flood control engineer Richard Putney resigned from the HCFCD. Putney had been with the flood control district since the project had begun construction during the war. Putney was replaced by his technical assistant Howard Jensen, who had previously worked at the Corps’ Galveston office. At the same time, the Galveston District was transferring much of its flood control expertise to Fort Worth, which was in charge of the much larger multi-purpose river projects in the region.

Despite its high cost, a new flood control plan was approved by the Harris County Commissioners Court in June 1950. The four main bayous running through the expanding metropolitan area would all be cleared, widened, and lined with concrete in some sections. HCFCD still hoped that, somehow, shorter versions of the north and south canals would be part of the system. With the “combination of advanced costs and city growth” the projects were now estimated at \$60-70 million.<sup>163</sup> When complete it was supposed to produce \$20 million in benefits, annually, to Harris County. The Corps held a public hearing on the revised plan that same month.

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<sup>162</sup> “County Flood Control to Cost \$20 Million: District Hires Engineer for Re-Survey,” *Houston Post*, February 17, 1950, Squatty Lyons Papers, Harris County Archives.

<sup>163</sup> “New Flood Control Plan,” *Houston Post*, June 10, 1950, Squatty Lyons Papers, 1950, Harris County Archives.

### The frustrations of financing the next phase of the Buffalo Bayou Project, 1951–1956

Seeking to bypass the Corps' lengthy restudy process, Harris County leaders returned to Washington in July 1951. This time they sought only a \$1 million appropriation to continue clearing Brays Bayou, with full expectations that it would be the beginning of regular funding for the next phase of the project. War had broken out on the Korean peninsula the month before, and Harris County's representatives were quick to justify the need to move ahead on suburban flood control in terms of the critical defense industries located along the Houston Ship Channel. This justification had worked in World War Two to release funds to complete the two main dams on Buffalo Bayou. Now representatives from the HCFCD, the navigation district, the chamber of commerce, and the city of Houston reprised a key piece of early marketing – the “Wild River” pamphlet that had convinced the Texas legislature to approve a new flood control district in 1937.<sup>164</sup>

The updated version of “Wild River” was full of pictures of floods, old and new, along with statistics showing how much Harris County had grown over the last 15 years. It made the pitch that the need to protect expensive development both justified another federal project, and at the same time made it impossible for the county to pay for improved drainage alone. Over 20 years, from 1930 to 1950, Houston's population had almost exactly doubled from 292,000 to 600,000 residents. But during that same period, the value of building permits increased by a factor of ten, from \$17.6 million to \$176 million, perhaps making an unfair comparison between Depression-era stagnation and

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<sup>164</sup> Harris County Flood Control District, “Wild River: A Pictorial Petition as Presented to the Subcommittee on Civil Functions, Senate Appropriations Committee,” July 28, 1951, Auditors Papers, Harris County Archives.

postwar prosperity. “Wild River” also captured its moment of Cold War hyperbole. “Repetition of this area’s flood of 1935 would be the equivalent of an atomic bomb dropped on the City of Houston in terms of the disruption and loss of production in the locality,” it screamed. “Many of the new industries, particularly chemicals and oil, have been established since 1935.”<sup>165</sup>

Despite the glossy piece of marketing, and the real strategic importance of refining industries in Houston, the junket to Washington was a failure. The Corps of Engineers went on the record against the requested \$1 million appropriation. The Board of Engineers was rightfully wary of allowing new construction to begin before a restudy of the entire project was complete. After all, the dams on Buffalo Bayou were protecting the industry along the ship channel; it was the suburban neighborhoods that needed flood protection, and these areas were not critical to national defense during the current emergency.

Early the following year, in January 1952, the HCFCD completed the \$9 million county drainage program that had been started in 1945. Local drainage efforts had accomplished all they could by clearing of underbrush from the bayous, and moving dirt from smaller creeks that fed into them. New excavation work would have to wait for federal funding. “If we don’t get the federal funds, we’ll just bog down,” county flood control engineer Howard Jensen declared. “We have the work almost completed on all

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<sup>165</sup> Harris County Flood Control District. The new *Wild River* petition emphasized major facilities built during and after the war along the Ship Channel - such as the Dickson Gun Plant, Diamond Alkali Plant, Goodyear synthetic rubber and Sinclair Refinery expansion - that were now in the path of a flood if it met “project proportions” (because the diversion canals were never finished). These facilities were real indicators of how important Houston was becoming as a petrochemical center after the war.

water arteries flowing into the three bayous. But when the year is over, we'll be broke – unless we get the federal money we've asked for.”<sup>166</sup>

That summer, drainage concerns centered around another community health crisis. The county health department blamed a new outbreak of polio on raw sewage being dumped in the bayous. Authorities responded by spraying pesticides to kill the flies that they assumed were spreading the disease. It was clear that there was not enough treatment of sewage at the county's 54 disposal plants, but homeowners in southwest Houston blamed poor drainage. They crowded a meeting of the Commissioners Court demanding that one particularly noxious drainage ditch leading to Brays Bayou through the backyards of West University Place homes be covered or lined with concrete. Howard Jensen estimated that it would be \$320,000 to line that ditch alone, for a couple of miles.<sup>167</sup> By October the city of West University Place had undertaken the project on their own because the county did not have the funds to take on the project.

Finally, in August 1952 the Board of Engineers approved modifications to the 1940 project on Buffalo Bayou. The restudy had taken three years. As had been anticipated, the north and south canals were now completely gone from the plans. The project would cost \$50 million, with the federal portion limited to \$26 million, and it would only attempt to “clear, enlarge, straighten and line if needed” Buffalo, Brays, and

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<sup>166</sup> Elmer Bertelsen, “Harris County's \$9 Million Drainage Improvement Program Nearing Completion,” *Houston Chronicle*, January 20, 1952, Squatty Lyons Papers, 1952, Harris County Archives.

<sup>167</sup> “Stopping Bayou Pollution Vital to Effective Anti-Polio Drive,” *Houston Post*, June 10, 1952, Squatty Lyons Papers, 1952, Harris County Archives.



White Oak bayous.<sup>168</sup> But with the ongoing Korean War and an election that year, Congress did not pass a rivers and harbors bill. County leaders were left facing the same challenge: how to raise funds on their own.

In June 1953, county commissioners scheduled another bond vote. At \$39 million, it was the largest ever submitted to Harris County property owners. Voters were told that financing the new debt would likely raise property taxes. Of the total, \$11 million was set for flood control, \$11.5 million was for county roads, and \$15 million was for the navigation district to improve the Houston Ship Channel. There was also \$1.5 million for a new county courthouse and jail. Local papers, such as the *Houston Post* and the *Houston Informer*, again supported the bonds, and decried “intolerable” motor traffic.<sup>169</sup>

Meanwhile flooding, and the never-finished comprehensive system, was becoming too routine. “[T]he flood control system is only partially finished. It must be completed sooner or later, so the sensible course is to vote the bonds and get the protection as soon as possible. No one knows when another disastrous flood like those of 1929, 1935, 1945 and 1949, which caused damages aggregating more than \$21 Million,

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<sup>168</sup> General Lewis A. Pick to Secretary of the Army, “Letter Approving Modifications to Buffalo Bayou and Tributaries Project,” August 1952, Auditors Papers, Harris County Archives. Lieutenant General Pick was Chief of Engineers from March, 1949 until January, 1953.

<sup>169</sup> New suburban neighborhoods that were affected by flooding were mostly white, but sections of Brays Bayou also passed through African American neighborhoods, such as the Third Ward. The city’s weekly African American newspaper, the *Houston Informer*, also published an editorial in support of the 1953 bond referendum. The paper noted that Negro voters rarely participated in these county elections, but despite Jim Crow policies, “Negro Voters Have Part to Play in Growth of County.” The traffic bottlenecks were affecting everyone, and better drainage will “benefit all citizens”. Although the paper was skeptical about funding for the new courthouse and jail and what facilities it would provide for African Americans, it urged its readers to support the other measures. “Let us for one time think as citizens and do our part to further the growth of Houston,” the editors wrote. “As it prospers, so will we.” (Harris County Archives, Squatty Lyons Papers, 1953)

may visit the county.”<sup>170</sup> By the end of the month, all the bond issues were approved as well as a 3-cent tax for maintenance of the existing flood control system. Since they were limited to registered property owners who were motivated to turn out, these local bond referenda continued to come down to small numbers. Only 21,000 total votes were cast; but it was 7,000 more than the last bond referendum in 1950.

A year later, in September 1954, the Flood Control Act of 1954 finally authorized the second phase of the Buffalo Bayou Project. It would be a \$67 million comprehensive flood control program for Harris County based on the results of the Corps’ restudy. In general, it involved expanding on the HCFCD’s drainage program; lining the primary bayou channels with concrete, clearing brush, and sodding their banks. Local sponsors were committed to paying \$29 million – or 40 percent of the project’s costs. It was five years since the last bout of suburban flooding on Brays Bayou, and the local drainage program was still struggling to keep up with the pace of development in the area. After months of congressional debate, the persistent efforts of the county to raise bond funds for local, stop-gap drainage seemed more fully justified.

But even having an approved second phase of the federal project did not mean construction could begin any time soon. As would be the case with the later phases of projects in Miami and Tampa, this second phase of the Buffalo Bayou Project was held back by the annual appropriations cycle. The risk of recurrent flooding on Brays Bayou was especially high, and county leaders did not want to wait. In the spring of 1955, another county junket to Washington failed to get firm answers about the start of

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<sup>170</sup> “Editorial: Bond Issues Vital to County’s Growth,” *Houston Post*, June 24, 1953, Squatty Lyons Papers, 1953, Harris County Archives.

construction from the Army Engineers. County judge Bob Casey, flood control engineer Howard Jensen, and County Commissioner Kyle Chapman went to Washington seeking approval for the first construction funds needed to fully line Brays Bayou (which was estimated to cost \$25 million of the \$67 million authorized total). Enough studies had been done by 1955 that funds appropriated that year could be used to get started immediately.<sup>171</sup>

Alternatively, the Corps said that the county could lend them the money to get started, but commissioners such as Squatty Lyons said no, that they had tried this approach in the past, and that Harris County was still owed \$2.9 million that had been lent to the federal government in order to start construction on Barker Dam during World War Two.<sup>172</sup> Phase Two was supposed to be a “funds matching” program, with about half from the county, half from the federal government. Without an appropriation in 1955, it was back to the same local stop-gap drainage efforts. “Federal procrastination had the county fathers in a ‘do-it-yourself’ mood” the *Houston Press* commented.<sup>173</sup>

In September 1955, another referendum on a new bond issue of \$18.5 million was scheduled. The bulk of this funding would go to county roads, but the navigation district also requested \$5 million for new facilities and acquiring sites to dump spoils from dredging out the ship channel. There was no additional county drainage funding. This time, county leaders had to admit that Harris County’s increasing indebtedness would

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<sup>171</sup> William Taylor, “Flood Control Trip to Capital Inconclusive,” *Houston Press*, May 11, 1955, Squatty Lyons Papers, Harris County Archives.

<sup>172</sup> Houston Chamber of Commerce, “Minutes of the Flood Control Committee,” April 9, 1956, Auditors Papers 394.5, Harris County Archives.

<sup>173</sup> Taylor, “Flood Control Trip to Capital Inconclusive.”

lead to higher property taxes. Simultaneously, Harris County proposed a 33 percent increase to the licensing tax for motor vehicle registrations. The “wheel-tax” would pay for the rights-of-way for state and federal highways. “The first freeway and highway ‘pay as you ride’ development program in the county’s history,” county judge Bob Casey declared. It would give a “green light” for a freeway program “second to none in the nation.”<sup>174</sup>

Despite a newspaper campaign sounding alarms that traffic was “out of control,” and only these measures could solve it, voters saw the bond referendum as a package of new taxes with no certain return, and rejected the bond proposals. The “wheel-tax” for rights-of-way passed, but it would eventually die in the Texas Supreme Court. “What’s the Matter with Our Houston?” the *Houston Press* editorial read. “We’ve Lost Our Trust... Do we not still believe in a “better Houston?” With county commissioners’ and chamber of commerce flood control committee frustrations mounting, another referendum was scheduled for the following July 1956 during the Democratic primary.

In June, the chamber of commerce flood control committee met; finally, there was good news from Washington. Senator Lyndon Johnson sent a telegram saying an appropriation of \$6.9 million for Buffalo Bayou had been made by the Senate appropriations committee. More than \$4 million of that amount was repayment of past loans from Harris County, but there was \$2.5 million to get started on the rectification of Brays Bayou. All that was necessary now was securing the local contributions. County leaders were exasperated. While there were signs that the federal government would be

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<sup>174</sup> “Freeway Net 2nd to None Seen,” *Houston Post*, September 20, 1955, Squatty Lyons Papers, 1955, Harris County Archives.

coming to the rescue for flood control and highways soon, taxpayers were not supporting local efforts that had been taken for granted since the end of the war.<sup>175</sup>

The flood control committee then discussed how to build support for the bond referendum scheduled for the July Democratic primary. They were asking voters to approve even more money this time than they had the previous year. Total bonds would be \$23.5 million; \$15 million for freeway rights-of-way, \$7.5 million for flood control projects, and that was contingent on getting the 1940 loans paid back by the federal government. The flood control committee decided that the best framing to sell flood control to voters would be that it was “the most affordable form of flood insurance.”

Meanwhile, the chamber of commerce’s highway committee, needing to win a much harder two-thirds majority on their proposition for the referendum, hired an advertising firm to gain support for the highway bonds. The campaign would include billboards at particularly famous traffic bottle-necks, 15-minute television “programs,” and newspaper ads. The advertising campaign would cost \$7,000. The flood control committee, not to be outdone, decided to raise \$1,500 for their own newspaper campaign “with pictures – drainage as well as flood control should be stressed.” The *Houston Post*

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<sup>175</sup> Department of the Army, Corps of Engineers, *Annual Report of the Chief of Engineers, U.S. Army*, vol. 2, 2 vols. (Washington, D.C.: U.S. G.P.O., 1960). In the following years, the federal government did ultimately come through with appropriations for the second phase of the Buffalo Bayou project. In 1956, only \$100,000 was appropriated, but by 1960 an additional \$17 million had been made available for new construction (mostly rectification of Brays, White Oak, and sections of Buffalo Bayou). Meanwhile, the June, 1956 Federal-Aid Highway Act provided stunning increases in the financing available for highways that would become part of the interstate system. But, as County Judge Bob Casey commented, “it is no cure-all for the ailing right-of-way program in Harris County.” New infrastructure only relocated traffic congestion and suburban flooding to other parts of the city. And by the late 1960s, the rectification project on Buffalo Bayou would provoke a grassroots environmental response to preserve the natural beauty of Houston’s waterways. I discuss this next phase in Chapter 4, in comparison to the environmentalist responses to infrastructure in Miami and Tampa.

and *Chronicle* dutifully wrote editorials in support of the bonds, again reminding the city's influx of new residents how bad the area had flooded in the past. "There are several hundred thousand people in Harris County who were not here during the great flood of 1935, and many others who were not here during the lesser floods of 1945 and 1949," the *Post*'s editorial read. "They were not pleasant."<sup>176</sup>

But all the bond propositions were rejected in the July Democratic primary vote. It was another major failure for the county commissioners and their allies at the chamber of commerce. "A jolting setback," the *Chronicle* wrote. "The urban freeway system must be completed or Metropolitan Houston will strangle in its own traffic." The *Post* declared that Houston's legacy as Texas' center of commerce was now at stake. "This is a crisis in the progress of the Houston area," the *Post* wrote. "It must be recognized as such, and met."

Part of the problem was that that summer southeast Texas was experiencing a severe drought – one of the worst since the early 1930s. This kind of cycle – flooding followed by drought – was much more acute in South Florida, and the political tension between flood control and water supply was much more pronounced in both Miami and Tampa than in Houston. In the 1950s, traffic seemed to be getting worse every day, but flooding was not a big concern for many residents of Houston's suburbs. It had been seven years since the last major flood. People living in new areas developed near the water retention areas behind Addicks and Barker dams had never seen the reservoirs holding any water. The newspapers published maps of the incomplete flood control

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<sup>176</sup> "County Bond Issues Will Build Freeways and Control Floods," *Houston Post*, July 16, 1956, Squatty Lyons Papers, Harris County Archives.

system, trying to remind readers of the system that was protecting them, but the county and chamber of commerce decided to put all its resources behind a campaign for freeway bonds, scheduled for the next vote in September that year.

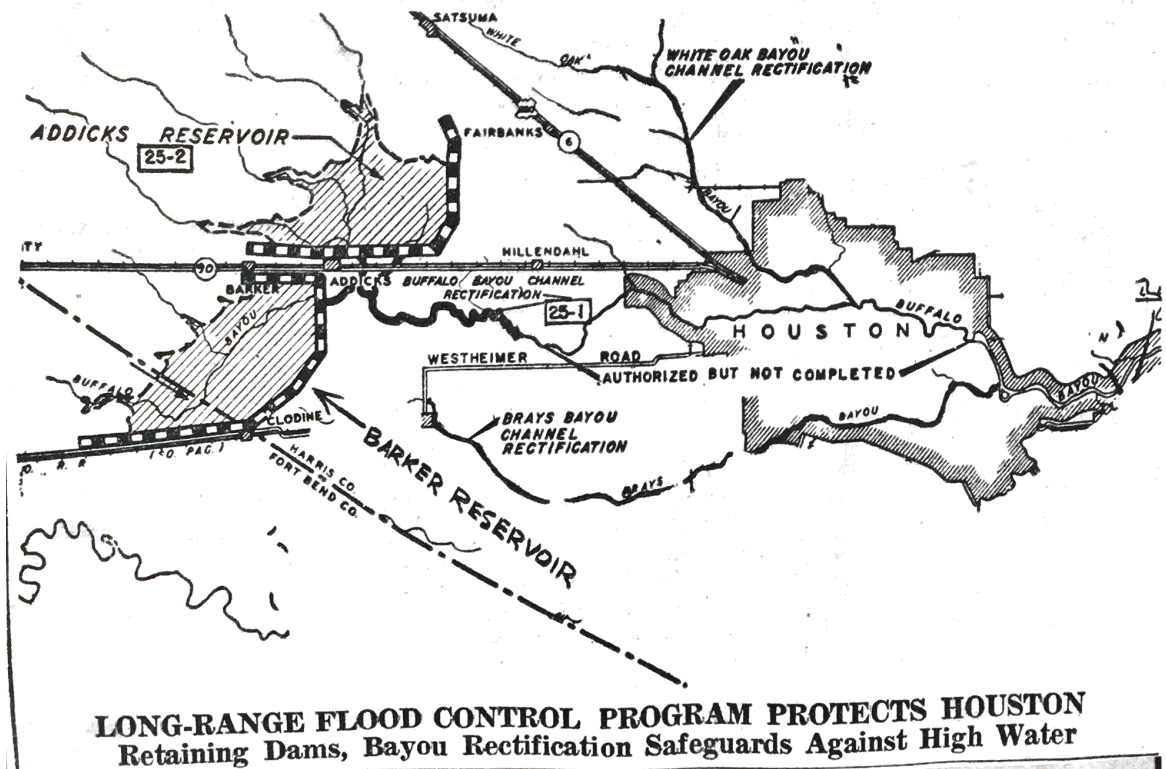


Figure 2.11 Map of Houston's flood control system published before bond referendum. *Houston Post*, 1956. Squatty Lyons Papers, Harris County Archives.

The campaign was highly visible and well-covered. It became a referendum on the effectiveness of both political and business leadership in Houston. On this third attempt, with a national program for generously financing highways in the news, all the bond propositions finally passed. The freeway bonds were approved by voters overwhelmingly, at a majority of 4 in favor to 1 against. Houston would have its freeways, and it would have its main bayous lined in concrete, and for the next decade there would be widespread support for this form of suburban development and drainage.

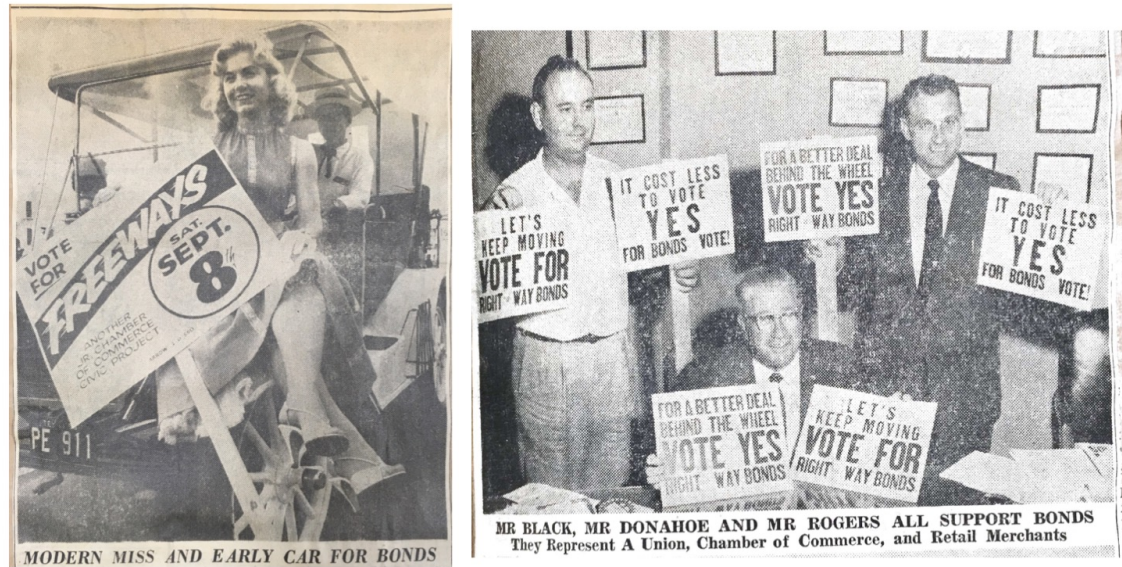


Figure 2.12 Freeway bond campaign coverage, 1956. Squatty Lyons Papers, Harris County Archives

## Chapter summary

Over a twenty-year period, Houston recovered from catastrophic urban flooding and saw significant flood control projects started after four years of debate and delays. These projects were never to be completed as designed. But Houston's value to the war effort – its munitions depot, shipbuilding, and petrochemical complex – all helped justify the rapid completion of Barker and Addicks dams.

Twenty years changed Houston from a fairly compact city surrounded by rural land to a sprawling center for the oil and gas industry. In 1948, the flood control projects were only 25 percent complete, but county leaders, who had always worried about their ability to secure funds for local contributions to the federal projects, decided the original plan was far too expensive to see truly finished. Instead, business leaders and county officials supported the Corps' restudy of the Buffalo Bayou project which would weigh the high costs of suburban land against the need to provide some flood protection to those new suburbs.



A new plan took shape in the 1950s: comprehensive flood control in the form of improved drainage instead of canals, levees, and additional dams. At first, it was easy to raise funds through bond elections to pay for the local pieces of these suburban drainage projects. Flood control was often on the same ballot as local freeway development and improving the Port of Houston. But by the late 1950s, it took persistent campaigning to continue funding the local projects to straighten and line the bayous with sod and concrete. Although funding did eventually come through, these stalled channelization efforts would also come to a halt in the late 1960s, this time in large part due to equally persistent grassroots environmental campaigning.

### CHAPTER 3

#### KEEPING THE SUBURBS DRY AND WATERED: FLOOD CONTROL IN MIAMI, 1947-1972

##### **Miami – a landscape like no other**

South Florida is a landscape where all fresh water is channeled, collected, and metered by a massive system of civil works infrastructure developed by the U.S. Army Corps of Engineers in the 1950s. The power of all those levees, canals, and pumping stations to transform the beautiful and subtle Everglades ecosystem has been the subject of highly critical scholarship.<sup>177</sup> Michael Grunwald's epic narrative *The Swamp: The Everglades, Florida, and the Politics of Paradise* (2007) delves into the decline of the Everglades from a wilderness frontier to a compartmentalized, degraded preserve at midcentury, to the current multibillion-dollar federal program to restore the Everglades National Park and surrounding wilderness preserves back to something approaching their former wild state. Grunwald argues that after the floods of 1947, the Central and Southern Florida (C&SF) flood control projects "set the stage for south Florida's spectacular postwar development," but this development came at a huge cost. "Half the Everglades is gone. The other half is an ecological mess," he writes.<sup>178</sup> Grunwald

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<sup>177</sup> Stephen S. Light and J. Walter Dineen, "Water Control in the Everglades: A Historical Perspective," *Everglades: The Ecosystem and Its Restoration* 5 (1994): 47–84; D. McCally, G. R. Mormino, and R. Arsenault, *The Everglades: An Environmental History* (University Press of Florida, 2000); Michael Grunwald, *The Swamp: The Everglades, Florida, and the Politics of Paradise* (New York: Simon & Schuster Paperbacks, 2007).

<sup>178</sup> Grunwald, *The Swamp*, 6.

squarely blames the Corps of Engineers – “the ground troops in America’s war against nature” – for this environmental disaster. He harshly frames the Corps of Engineers as arrogant in its desire to control entire watersheds over thousands of square miles and as dismissive of the ecological consequences of its projects. He argues the Corps can never restore the Everglades because it has not changed the kind of domineering thinking that destroyed the ecosystem in the first place. “The agency is still unrestrained and unreformed,” Grunwald writes.<sup>179</sup>

In response to these kinds of sweeping critiques the Jacksonville District of the Corps of Engineers worked with an external research firm to write an institutional history of the Everglades projects. In *River of Interests* (2012), Godfrey and Catton argue that the Corps has always been trying to balance the competing interests of developers, civic boosters, farmers, conservationists, and others. Some of those interests were more vocal, and more politically effective, than others at different points in time. “For many years, the people of South Florida generally regarded flood control and water supply as more important than fish and wildlife issues,” the authors argue, “and in the eyes of many observers, the Corps’ C&SF Project accordingly shunted ecological concerns aside.”<sup>180</sup> Mistakes were made often out of “innocent ignorance” of how profound the ecological impacts of water control could be. Those impacts can best be seen as unintended consequences of large-scale, governmental action to address the most salient public concerns of the time.

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<sup>179</sup> Grunwald, 373.

<sup>180</sup> Godfrey and Catton, *River of Interests*, 290.

This chapter focuses on the floods of 1947 and the C&SF flood control projects that followed, and it leans heavily on previous scholarship. While the ecological drama of the Everglades cannot be ignored, my goal for this comparative project is to understand how flood control affected the development of the Miami-Fort Lauderdale-West Palm Beach megaregion. Flood control allowed for a particular kind of affordable, low-density suburban development in South Florida that would not have been possible, in that form, without major federal works. The C&SF project was successful in creating large areas of reliably dry land that could be rapidly developed into affordable postwar housing. This federal and state investment made Florida living accessible to millions of former servicemen, their families, and retirees. As the southeast coast of Florida was transformed into a sprawling megacity, which by 1980 stretched for a hundred miles across three counties, supplying enough clean, fresh water was a constant problem. Flood control in South Florida caused perennial water crises because it both changed the natural water cycle and created the territory for new development.

Focusing on the Miami metropolitan area allows me to make comparisons with the case of flood control in Houston a decade earlier and Tampa a decade later. In a few critical ways Miami is an outlier. In contrast to Houston and Tampa, there is no significant industrial base in Miami. Its economy has always been service-oriented: tourism, real estate, banking, and logistics. As an article in *Esquire* magazine articulated during some of the city's hardest years, "Miami doesn't produce much. It *processes* things – money, information, hopes, dreams."<sup>181</sup> Its early success was because of its

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<sup>181</sup> TD Allman, "The City of the Future: Despite Its Problems, Miami Is the New York and Los Angeles of Tomorrow," *Esquire Magazine*, February 1983, HistoryMiami.

warm and beautiful location – not because of any geographic or strategic advantage.

Miami represents by far the largest civil works project of the three cities, with significant construction still in progress today on Everglades restoration.

While the Corps of Engineers' projects in Houston were run out of the Galveston District, of the Southwestern Division headquartered in Dallas, both Miami's and Tampa's projects were run by the Jacksonville District, with headquarters of the South Atlantic Division in Atlanta. There were significant bureaucratic barriers for lessons learned about flood control to cross the Gulf of Mexico and impact plans for South Florida. But I argue that while Houston may not have been a precedent for Miami, there are more similarities between civil works in southeast Florida and Texas than comparing those projects with the long history of flood control in the area around New Orleans.

After World War Two, both Miami and Houston were challenged by suburban development and the inadequate legacy of past flood control projects. Where Houston ran into financial limits, the fate of Miami became tied to the destiny of greater South Florida, and that state-level political support opened up possibilities for transformative infrastructure that were quickly dismissed as too expensive on the coast of Texas. Miami's postwar projects also show how the priorities of Florida politicians changed over time from emphasizing flood control and development to protecting natural resources.

### **How the South Florida landscape constrained development before 1947**

In the subtropical landscape of southeast Florida, land and water come together in dramatic ways that attracted millions of visitors and new residents throughout the twentieth century. The southern tip of the Florida peninsula is so flat and low-lying that only a few feet of elevation make the difference between wet and dry. Miami itself is a city surrounded by water. The site where Henry Flagler's Florida East Coast Railroad

first started developing a resort town in 1895 was on the high ground of the coastal ridge at the mouth of the small Miami River.<sup>182</sup> To the east of this ridge were the shallow waters of Biscayne Bay. A string of long, narrow barrier islands on the far side of the bay offered some protection from Atlantic storms for Flagler's hotel and growing town. Starting just before World War One, the development of Miami Beach on one of those barrier islands transformed the mangroves and dunes to create a vacation destination directly on the Atlantic Ocean.

Immediately to the west of the coastal ridge and the town of Miami were the vast wetlands of the original Florida Everglades. This diverse ecosystem covered almost the entire southern end of the peninsula. During the rainy season water from Lake Okeechobee, ninety miles to the northwest of Miami, pooled, spilled over, and then slowly flowed through ponds, hammocks, sawgrass marshes and sloughs to the Bay of Florida and the Gulf of Mexico.<sup>183</sup> The water in Lake Okeechobee was often only 12 feet above sea level. The journey across South Florida to a sea level was a slow, sheet-flow of water over a period of months, a process conservation journalist Marjory Stoneman Douglas famously called "The River of Grass."<sup>184</sup> In dry parts of the year the water from Lake Okeechobee was only a trickle, and parts of the Everglades occasionally burned.

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<sup>182</sup> Nixon Smiley, *Yesterday's Miami* (E.A. Seemann Pub.: Miami, Fla., 1973).

<sup>183</sup> Steven M. Davis and John C. Ogden, eds., *Everglades: The Ecosystem and Its Restoration* (Boca Raton, FL: CRC Press, 1997), 49.

<sup>184</sup> Godfrey and Catton, *River of Interests*, xii.



Figure 3.1 Road map of South Florida showing extent of Everglades and early drainage canals, c. 1927. Florida Memory, State Library and Archives of Florida.

For any large and lasting human settlement beyond the barrier islands and coastal ridge, the seasonally flooded landscape of the Everglades had to be drastically altered. As *Miami Herald* reporter Jeanne Bellamy wrote in 1948 in a series of articles meant to educate the public about flood control, “Without water control, Everglades land could not be farmed, and the cities of Florida’s East Coast would be confined forever to the limits of the ridge on which they started.”<sup>185</sup>

After many grandiose and failed attempts to completely drain the vast swamp in the nineteenth century so farmers could make use of the rich peat soils below the

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<sup>185</sup> Jeanne Bellamy, “Taming the Everglades: A Report on Water Control” (*Miami Herald*, 1948), Box 6.4, HistoryMiami, Jeanne Bellamy Water Resources Collection.

marshes, the state of Florida created the Everglades Drainage District in 1905.<sup>186</sup> The drainage district had the power to raise taxes on landowners and use those funds to dig canals and build dikes that would reclaim year-round areas of dry land upstream. The canals would also help to at least partially control floods. But farmers in the Everglades still faced huge challenges including subsiding muck soils, lack of nutrients, and peat fires during droughts.<sup>187</sup> Although reclamation did not bring the large number of settlers that developers had hoped for, and the drainage district never could pay its debts to the state, the canals and dikes were responsible for making more land available for farming south of Lake Okeechobee and attracting a small population to that midsection of the peninsula to work in agriculture.<sup>188</sup> Many smaller, drainage sub-districts in Dade County also raised funds, more or less successfully, to reclaim land from the wetlands directly to the west of Miami's original downtown area.<sup>189</sup> The drainage districts financed ditches, dikes, and pumping stations to contain and channel water away from areas to be developed into farms and planned resort communities. By the early 1920s over \$17 million had been spent by the state and the local drainage districts on canals and locks.<sup>190</sup>

After the First World War Florida first became famous for selling the dream of planned communities in the sun.<sup>191</sup> The heavily promoted new towns of Coral Gables,

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<sup>186</sup> Gail Clement, "Everglades Drainage in Earnest (1900 - 1919)," Everglades Digital Library, Florida International University, accessed January 20, 2016, <http://everglades.fiu.edu/reclaim/timeline/timeline6.htm>.

<sup>187</sup> Davis and Ogden, *Everglades: The Ecosystem and Its Restoration*, 330.

<sup>188</sup> Grunwald, *The Swamp*, 185.

<sup>189</sup> Paul S. George, "History of Miami," HistoryMiami, accessed January 20, 2016, <http://www.historymiami.org/research-miami/topics/history-of-miami/>.

<sup>190</sup> "Publicity Piece - 'Florida's Aladdin Touch'" (Christian Science Monitor, December 20, 1948), Jeanne Bellamy Water Resources Collection, HistoryMiami.

<sup>191</sup> Paul S. George, "Brokers, Binders, and Builders: Greater Miami's Boom of the Mid-1920s," *The Florida Historical Quarterly*, 1986, 27-51.



Hollywood, and Boca Raton were all designed to attract wealthy northern investors during this period. Miami quadrupled its population from a small town with less than 9,000 people in 1910 to a small city with more than 36,000 permanent residents in 1920. The state's population as a whole grew by 30 percent in five years to 1.2 million people. Two major hurricanes struck Miami and other cities along the newly imagined "Gold Coast" in 1926 and 1928 and marked the end of the first Florida land boom. High winds damaged most of the hotels on Miami Beach and new offices in downtown Miami, which was slowly becoming more than just a winter resort.<sup>192</sup> Storm surge forced the hulks of schooners out of their moorings on Biscayne Bay and slung them onto Bayfront Park. Flooding, however, was not a major impact of the storm. Concern about future hurricanes was also not a big part of the storm's aftermath. Environmental historian Ted Steinberg notes that the *Miami Herald* was so focused on local boosterism and development that its coverage of the 1926 storm vastly underplayed the damage to the city.<sup>193</sup>

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<sup>192</sup> Smiley, *Yesterday's Miami*, 82.

<sup>193</sup> Steinberg, *Acts of God: The Unnatural History of Natural Disaster in America*, 63.



*Figure 3.2 Ships stranded in Bayfront Park after 1926 Miami Hurricane. Florida Memory, State Library and Archives of Florida.*

The Great Miami Hurricane (1926), followed soon after by the Okeechobee Hurricane (1928), which killed around 2,500 people around the lake, followed by the Great Depression, combined with the financial troubles of the local drainage districts, created a long hiatus in the development of new suburbs in the Everglades. It was only the start of the Second World War that began to reinvigorate the Miami area. During the war years, the small Port of Miami was taken over entirely by the U.S. Navy for use primarily as a training center for submarine chasers. South Florida also presented excellent year-round training conditions for naval aviators, and several naval air stations were commissioned from existing commercial airport facilities in the area. Most of the hotels on Miami Beach were taken over by the army and turned into personnel

housing.<sup>194</sup> Wartime training in Miami gave thousands of servicemen their first experience of Florida recreation and sunny winter weather. After the war many would return to vacation and buy homes.

Developers were waiting for them. Suburbs that had been planned in the land boom of the 1920s suddenly became real towns. Miami Springs, for example, had less than 100 residents in 1940. In 1950 there were more than 5,000. With an influx of veterans and their families, the small town of North Miami became one of the fastest growing in the country, with its population increasing by nearly 500 percent, from less than 2,000 in 1940 to more than 10,000 in 1950. North Miami became a city in 1953 and opened its first high school the next year. Further up the coast, Hollywood and Fort Lauderdale doubled their populations over the decade.

### **A Comprehensive, federal response to the floods of 1947**

The war years in South Florida were mostly dry and free from major storms. A hurricane and subsequent fire did lead to the destruction of massive airship hangers at the Richmond Naval Air Station near Homestead, but water shortages were more a concern than flooding.<sup>195</sup> Then, suddenly, in the spring of 1947, after several years of severe drought, the water cycle changed dramatically in South Florida. That year the southern end of the peninsula would get almost twice its average annual rainfall. Miami alone would get 102 inches of rain. In June and July a series of tropical storms began dumping large amounts of rainfall into the Lake Okeechobee watershed. The Everglades became

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<sup>194</sup> Mohl, "Miami: The Ethnic Cauldron," 60.

<sup>195</sup> Florida State Library and Archives, "Devastation from Fire at Richmond Naval Air Station during Hurricane," Florida Memory, accessed October 4, 2016, <https://www.floridamemory.com/items/show/38354>.

saturated. Then in mid-September and early October two hurricanes brought even more rain to the region. Fifteen inches of rain fell in Fort Lauderdale over a one-day period causing widespread flooding downtown.<sup>196</sup> The surface of Lake Okeechobee reached its highest recorded level – nearly 19 feet above sea level. Nearby drainage ditches and dikes were completely overwhelmed with overflowing water, and farmers fought to save their fields as drainage district officials sought to protect towns such as Belle Glade and Canal Point.<sup>197</sup>



*Figure 3.3 Flooding on Hammond Drive in Miami Springs, September, 1947. Martha Pierson on PBase.*  
<http://www.pbase.com/donboyd/image/80755884>

Just the year before Houston's new suburbs had seen a similar kind of flooding along Brays Bayou, but it had been more localized, thanks to the federal flood control projects completed during the war. In South Florida, the local, land boom-era drainage

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<sup>196</sup> Godfrey and Catton, *River of Interests*, 23.

<sup>197</sup> "Flood Waters Lapping at Belle Glade Edges but Town Seems Safe," *Palm Beach Post-Times*, September 23, 1947, Newspapers.com.

systems were entirely inadequate. West of Miami the drainage canals were at capacity, and water overflowed from the marshes of the Everglades and inundated newly sprawling subdivisions with affordable homes for returning servicemen. Access to Miami Springs and parts of Hialeah were completely cutoff, with thousands of residents stranded. Florida's National Guard was activated to provide relief. Three-quarters of Dade County was under standing water which did not recede for several days.<sup>198</sup>

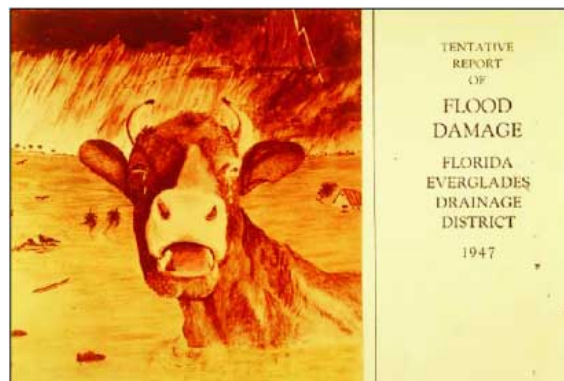


Figure 3.4 *Weeping Cow* book. 1947. South Florida Water Management District

Total damages from the flood of 1947 were estimated at between \$60 and \$90 million, and annual flooding in the region at more than \$11 million.<sup>199</sup> Local governments and boosters clamored for greater flood protection than the state could provide on its own without delay. As the editor of the *Palm Beach Post* sensationalized, “Men sweat and strain and fight to erect dikes against the wash....Lake Worth, Boynton, Delray, Boca Raton, Fort Lauderdale and Miami are flooded past recollection of man to

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<sup>198</sup> W. Turner Wallis and Dade County Public Works Department, “Water Control in South Florida with Special Reference to Dade County,” 1958, HistoryMiami, Jeanne Bellamy Water Resources Collection.

<sup>199</sup> US Congress Committee on Public Works, *Comprehensive Report on Central and Southern Florida*; AG Matthews, “Letter to Jeanne Bellamy,” June 16, 1948, Jeanne Bellamy Water Resources Collection, HistoryMiami. Damage estimates were revised upward dramatically in the year following the floods.

compare. Disease breeds in floods. It is no time for politics, it is a time for remedies, if necessary, for drastic remedies.”<sup>200</sup> Unable to provide any solutions for future storms, the beleaguered Everglades Drainage District turned to campaigning for outside intervention. It sent out a “tentative report on flood damage” with a dramatic drawing on the cover of a weeping cow, barely keeping its head above the water, surrounded by flooded Everglades farms. The thin book showed aerials of flooded orange groves and subdivisions in Hialeah, flooded roads and fields south of Lake Okeechobee, and dead cows in fields in Palm Beach County.<sup>201</sup> The “Weeping Cow” book, in very much the same role as “Wild River” pamphlet in the case of Houston, helped make the case that the damage was too profound for local authorities to handle. It was the beginning of a campaign to bring in federal money for a more lasting fix to South Florida’s water problems.

The idea of comprehensive flood control for South Florida, instead of local drainage efforts, was not new. There was already one major federal flood control project on Lake Okeechobee. The Great Hurricane of 1928 churned up storm surge on the lake, overwhelming the small dike built by the Everglades Drainage District and causing massive flooding in the surrounding towns and farmlands. The surge contributed to the second largest death-toll from a U.S. hurricane after the Galveston storm of 1900. In 1932 the Corps of Engineers began work on a longer and taller levee to hold back Lake Okeechobee from overflowing in future storms. The Hoover Dike, completed in 1938, was over thirty feet high and wrapped around the southern edge of the lake for nearly 70

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<sup>200</sup> Charles Francis Coe, “Progressive Calculation,” *Palm Beach Post-Times*, October 19, 1947, Newspapers.com.

<sup>201</sup> T. Huser, M. Kirchhoff, and P. Nicholas, *Into the Fifth Decade: The First Forty Years of the South Florida Water Management District, 1949-1989* (South Florida Water Management District, 1989), 5.

miles.<sup>202</sup> By the end of World War Two the costs of building and maintaining this defense around Lake Okeechobee had added up to more than \$25 million – surpassing all previous drainage and flood control costs in South Florida.<sup>203</sup>

Because of this massive structure the lake remained safely in its basin during the storms of 1947. But the suburban areas that had been recently developed closer to Miami, on top of the former Everglades wetlands, did not have enough drainage to prevent several feet of water from sloshing around the driveways of new GI homes for weeks. In the farms around lake Okeechobee the drainage was even worse, and the floodwaters covered fields for months. The 1947 floods threatened both the remaining agricultural areas and the rapid postwar development of the southeast coast.

Starting in 1949, and continuing for the next decade, South Florida would quietly become the site of the second most extensive flood control projects in the U.S. after the Mississippi Delta. The Central and Southern Florida (C&SF) Flood Control Project would manage water flows over 15,000 square miles of the lower peninsula, or one quarter of the entire state. In the first half of the twentieth century, the scope of federal flood control had been steadily expanding its mission in different regions of the country. For decades flood control on the Mississippi had been an expensive and controversial federal project.<sup>204</sup> Army Engineers had controlled the Sacramento River in California from seasonally inundating the state capital. Large dams generated power in the

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<sup>202</sup> Daniel Williams and Tom Singleton, *The South Dade Watershed Project* (Center for Urban and Community Design, University of Miami School of Architecture, 1995).

<sup>203</sup> “Florida’s Aladdin Touch.”

<sup>204</sup> Martin Reuss, *Designing the Bayous: The Control of Water in the Atchafalaya Basin, 1800-1995* (Texas A & M University Press, 2014), 11.

Tennessee Valley and along the Colorado River. In fact, the number of smaller dams planned around the country during this period would reach into the hundreds, thanks to dedicated federal funding.<sup>205</sup> Meanwhile, the federal flood control system on Houston's bayous was nearing completion.

In contrast to earlier federal flood control projects in the southeast region, there were almost no benefits of the C&SF Projects in postwar Florida to navigation.<sup>206</sup> The mission of the Corps of Engineers had been expanded after the Rivers and Harbors Act of 1936 to include flood control on waterways for the benefit of settlements and infrastructure. The 1936 act allowed for the calculation of economic benefits to justify flood control projects to include potential development in the region. For the postwar projects in South Florida the primary justification in terms of local benefits was "increased land use."<sup>207</sup> In 1948 the vast majority of lands to be protected from flooding were slated to be developed for agriculture. Urban and suburban areas, however, would expand rapidly during the early project phases and challenge the Corps of Engineers' initial expectations. Proponents of flood control estimated that there would annually be

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<sup>205</sup> Willingham, "The U.S. Moves towards More Integrative Approaches to Water Resources Management, 1970-2010."

<sup>206</sup> Godfrey and Catton, *River of Interests*. Improving navigation was still the primary justification for federal funding and Army Corps of Engineers projects in the 1930s. For example, Houston's flood control projects were justified primarily for their benefits to navigation at the Port of Houston. The dike around Lake Okeechobee, and the Okeechobee Flood Control District's maintenance of canals, was also justified as aiding navigation across the peninsula from the Atlantic Ocean, through St. Lucie canal, across lake Okeechobee, and into the Caloosahatchee River to the Gulf of Mexico. Flood control was a secondary benefit.

<sup>207</sup> US Congress Committee on Public Works, *Comprehensive Report on Central and Southern Florida*.



over \$24 million in direct benefits along with \$45 million from increased federal tax revenues as lands protected from flood control were developed.<sup>208</sup>

The C&SF flood control projects aimed to comprehensively and permanently transform the way water moved throughout the entire region. The Corps of Engineers' plan recognized that "flood protection, drainage, and water control were all interrelated problems in South Florida."<sup>209</sup> The scale of this management of the entire Lake Okeechobee and Everglades watershed was what distinguished the C&SF projects from all earlier flood control efforts in the area. The Corps of Engineers' plan was to build a series of levees and canals separating "dry" areas for development along the East Coast from large, shallow lakes designated as "water conservation areas" to the west. Diesel-powered pumping stations and hydraulic control structures located on the south side of Lake Okeechobee and along four main drainage canals would maintain water levels in the water conservation areas.<sup>210</sup> The water conservation areas could supply water to cities and farms during droughts and hold excess water during floods.<sup>211</sup> The very southern tip of the Everglades in a new Everglades National Park (dedicated in 1947 by President Truman during the winter before the floods) would be left in its "natural state".<sup>212</sup> There

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<sup>208</sup> Matthews, "Letter to Jeanne Bellamy."

<sup>209</sup> Godfrey and Catton, *River of Interests*, 25.

<sup>210</sup> Although most of the pumping stations were diesel powered, increasing demands for electrical power were part of the C&SF Project, and even more importantly, the development of South Florida. This is another demonstration of how the timing, at least, of flood control and rapid development were concurrent. One of the earliest plants in the region, at Dania near Fort Lauderdale, was built by Florida Power and Light in 1928 and was diesel powered. In the early 1960s, FPL built new, much larger oil-fired plants at Port Everglades and Riviera Beach (to serve the West Palm Beach area). As Dade County continued to expand to the south, and there were aborted plans to attract defense industries to the Everglades, the Turkey Point nuclear facility on Biscayne Bay was started in 1967.

<sup>211</sup> Godfrey and Catton, *River of Interests*, 26.

<sup>212</sup> Bellamy, "Taming the Everglades."

was no specification for how much water the new park would need in order to maintain that natural state.<sup>213</sup>

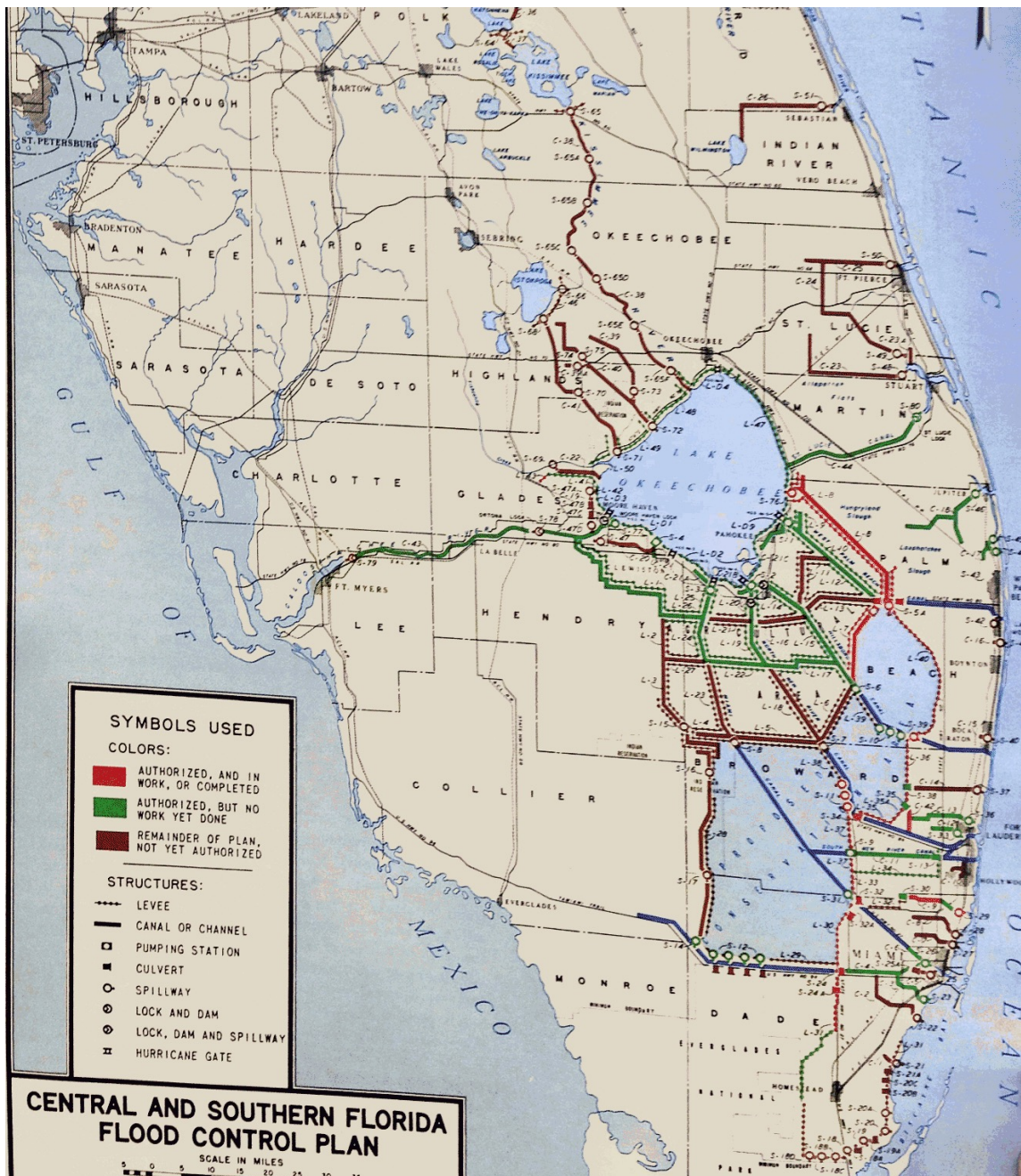


Figure 3.5 C&SF Plan, 1953. Records of the Jacksonville District, US Army Corps of Engineers, National Archives at Atlanta.

<sup>213</sup> Godfrey and Catton, *River of Interests*, 40.

Under the Flood Control Act of 1948 Congress first appropriated more than \$200,000 for the Corps of Engineers to begin surveying for flood control projects designed to protect the coastal cities and the agricultural areas near Lake Okeechobee. Lieutenant General Raymond A. Wheeler, who had been appointed the Army's Chief of Engineers in late 1945 after exceptional service in World War Two, had to walk a fine line in arguing for more flood control infrastructure without making it seem like previous federal projects in the region had failed. In the official 1948 report to Congress on flood control in central and southern Florida, General Wheeler's summary acknowledged that dikes and canals built by the Corps of Engineers were already in place on the south shore of Lake Okeechobee. That infrastructure had been designed to prevent true "disasters" – ones like the spillover deluge of 1928 – but the persistent problem of "too much water" in South Florida had not yet been solved.<sup>214</sup> Thanks to the Hoover Dike and canals, instead of a devastating flash flood, waters from the 1947 storm had taken months to slowly drain through the Everglades, and minor flooding events remained frequent in the region.

The recurrent problem of "Too Much Water" in the summer had its seasonal opposite in droughts, and infrastructure for flood control was also designed to mitigate water shortages. The recurrent problem of "too little water" was an equal justification for another round of flood control projects in South Florida. "During the dry years from 1943 to 1946, cattle died in the pastures of the Kissimmee Valley for lack of water," General Wheeler reported. "Smoke from burning muck lands of the Everglades darkened the

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<sup>214</sup> US Congress Committee on Public Works, *Comprehensive Report on Central and Southern Florida*, 1.

coastal cities; and salt water moved inland along drainage canals and through the underlying rock as the supply of fresh water diminished.”

Wheeler’s report declared that the new comprehensive flood control projects would stabilize the natural cycles that made life in South Florida unpredictable for new residents and longtime farmers. The civil works projects would allow fresh water to be retained for use during dry spells but also quickly diverted after heavy storms. As Colonel Mason Young, the Southeastern Division Engineer in Atlanta, wrote to the congressional Committee on Public Works, “If the coastal and Everglades sections of south Florida are to continue to prosper and develop, conservation of their water resources is as important and urgent as is provision of additional drainage and elimination of flood damage.”<sup>215</sup>

The fact that such massive transformations of the natural water cycle could cause ecological tradeoffs was recognized by other government agencies reviewing the Corps’ 1949 report.<sup>216</sup> To protect these resources, the Corps initially proposed releasing some of the water stored in retention areas for the benefit of the new Everglades National Park, especially during droughts. But these allotments of water for the national park did not end up being prioritized as the C&SF Projects became a reality, especially when demands for agricultural and drinking water competed with the needs of the remaining Everglades

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<sup>215</sup> US Congress Committee on Public Works, 60.

<sup>216</sup> US Congress Committee on Public Works, ix. The US Fish and Wildlife Service decried the loss of “certain unique wildlife habitats” in the Everglades even though that loss “may be overshadowed by benefit to fishery.” Stabilizing the water cycle in South Florida was supposed to help maintain fisheries in nearshore waters and especially the critical shrimp nursery in the Bay of Florida and its Everglades estuaries. The relationship between seasonal droughts, the lack of water in Everglades National Park, and the shrimp harvest remained uncertain. It was still being investigated in the late 1960s, two decades later.

ecosystem.<sup>217</sup> As Godfrey and Catton point out, the fear of a repeat of the 1947 floods overshadowed all other priorities such as protecting fisheries, wildlife, and landscapes in South Florida. There were too many people invested in the expansion of Miami's suburbs. "The looming fear of flooding felt by most Floridians steamrolled these concerns," they write, "and created a groundswell of support for the project that Congress could not ignore."<sup>218</sup>

#### The politics of raising local contributions to the federal projects

The process of advocating for federal flood control in South Florida went remarkably smoothly compared to earlier controversies in other states. Following the devastating floods of 1927, states in the Lower Mississippi River Valley had squabbled over federal compensation for disaster relief and new floodways.<sup>219</sup> In the late 1930s in Houston, local opposition to approving bonds for flood control had been significant, and the federal role in funding was still being defined. In contrast, Florida's business leaders, elected officials, and civic groups showed remarkable unity in making the case for a

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<sup>217</sup> Grunwald, *The Swamp*, 252. Grunwald implies that these were deliberately misleading promises for water to the National Park, such that ferocious conservationists such as Marjory Stoneman Douglas ended up supporting the C&SF Projects, at least initially. In my own reading of the Corps' 1949 *Comprehensive Report*, I see genuine concern for the Everglades and the belief, perhaps mistaken, that a more reliable supply of water would prevent the droughts that had seemingly "damaged" the National Park in the past. The system as built, however did not deliver nearly enough water to the park. Explosive population growth, well-connected agricultural interests, and unexpectedly severe droughts in later years all meant that there was very little extra water in the system to deliver to the Park or to the Bay of Florida. This was a situation that planners in the 1940s did not anticipate. Starting in the early 1990s, projects aimed to achieve Everglades Restoration have cost billions of dollars in an attempt to restore water to the Park.

<sup>218</sup> Godfrey and Catton, *River of Interests*, 29.

<sup>219</sup> Mississippi River Commission, "The Mississippi River and Tributaries Project: Floodways Information Paper," October 2007, <http://www.mvd.usace.army.mil/Portals/52/docs/Floodways%20info%20paper.pdf>.

transformational project. It was as if the coast of South Florida was the key to a postwar destiny for the entire state.

Up until that point, the interests of increasingly suburban South Florida seemed to diverge from the rest of the state's rural counties. State legislators from northern counties had controlled state politics through the "The Pork Chop Gang" for decades. In the post-Reconstruction era state constitution, representation in the state assembly was equal by county, regardless of population. As the population and economic importance of South Florida had grown, its representatives had to continually cater to the rural-serving, socially conservative agenda of Tallahassee. Yet, when it came to fixing South Florida's water problems, in contrast to the controversy in the case of Houston a decade earlier, there was the little question of why the whole state of Florida should raise funds for projects that would only benefit some of the southernmost counties.

This concerted effort by local and state officials, newspapers, and chambers of commerce was also due to the remaining threat of flooding in the near future, as the following spring of 1948 was again unusually rainy.<sup>220</sup> Anticipating federal support, county commissioners and local chamber of commerce in Palm Beach, Broward, and Dade counties hurried to raise funds so the Corps of Engineers could begin their initial studies for the C&SF Project. The army's deputy chief for flood control, Colonel Hebert Gee, noted that it was a "record" for the Corps of Engineers to move from a survey after a flood to an authorized project in just a year.<sup>221</sup> That summer state legislators also moved to condemn and replace the old Everglades and Okeechobee Drainage Districts with a

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<sup>220</sup> Godfrey and Catton, *River of Interests*.

<sup>221</sup> "Florida's Aladdin Touch."

new flood control district that could work with the federal projects across the entire region.<sup>222</sup> A local institution for regional flood control was a reality just one year after the disaster. This same process of creating an overarching flood control district and dismantling local drainage districts had taken four years in the case of Houston's floods.

As they made their case for funding in Congress that summer and fall, Florida's elected officials made sure to appear united around the need for flood control that they deemed essential for the state's continued development. This show of support was to convince Congress, but it was even more important to convince state representatives to put up the local contributions. In November 1948 the governor-elect, Fuller Warren, who had run as a progressive conservationist, addressed the State Chamber of Commerce declaring, "We have no choice, we have no alternative. Flood control involves the survival of this State."<sup>223</sup> Spessard Holland, a former Governor and now the state's junior senator, called for unity at the same meeting. "...the minute we split up, either in our delegation or back at home in our support of this project, that very minute we give up any hope to getting continued Federal support."

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<sup>222</sup> Matthews, "Letter to Jeanne Bellamy."

<sup>223</sup> Florida State Chamber of Commerce, "Understanding Florida's Flood Control Problem" (Orlando, FL, November 15, 1948), Jeanne Bellamy Water Resources Collection, Box 6, HistoryMiami.



*Figure 3.6 L-R: Gov. Warren, Chamber of Commerce President Walter Hays, Senator Spessard Holland and Senator Claude Pepper. c. 1949. Florida Memory, State Library and Archives of Florida.*

“Splitting up” would mean cities and farmers losing sight of the big picture and advocating for different solutions. Rural areas near the lake were sure to benefit, but the interests of the urban coast could also be served by the same projects. Senator Holland went on to point out that the flood control could provide a better solution to intractable, local problems such as maintaining supplies of fresh water to the city of Miami. Local water utilities were not usually a federal concern, but in the case of South Florida federal intervention might protect Miami’s groundwater for years to come. “The infiltration of salt water from the Atlantic has presented a tremendously grave problem in dollars and cents, in terms of limitation of that area insofar as its ability to continue to grow and serve



are concerned,” Holland said. “Of course, that problem does not lie within the field of exclusive Federal operation or the exclusive bringing of Federal relief.”<sup>224</sup>

At the same meeting, Florida’s senior senator, Claude Pepper, who had been a strong ally of Franklin Roosevelt during the New Deal, reminded attendees about just how important southeast Florida had become to the state’s economy. “There are a lot of things I want to see Florida have,” said Pepper, as he tried to justify the large costs of flood control to the state. The high value of coastal land and the attraction of tourism was the key to Florida’s postwar future. The influx of new residents was creating a burden on state resources, however. In addition to flood control, Florida desperately needed new schools and expanded facilities at state universities to handle demand from the GI Bill. “Our government is facing the burden of a tremendously growing state,” Pepper declared. “We have grown half a million since 1940.” The C&SF projects would affect “a fifth of the territory of this State, a third of our people, and half of our assessed value property,” Senator Pepper said. “Now if that is not a State project, what is? When do you get something that is of greater state significance than that?”

To continue making the case for what was projected to be \$37 million in local contributions, the State Chamber of Commerce worked with development boosters at local newspapers to get favorable coverage of the benefits of flood control.<sup>225</sup> *Miami Herald* journalist Jeanne Bellamy wrote a series of widely read articles with the title “Taming the Everglades” to promote the flood control projects. She argued that a comprehensive, federally backed solution was absolutely necessary because piecemeal

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<sup>224</sup> Florida State Chamber of Commerce.

<sup>225</sup> Florida State Chamber of Commerce.

efforts were bound to fail, as the state drainage districts had previously. “So vast and so flat is this region,” she wrote, “that trying to control the water in any small part, by itself, is about like trying to empty one side of a full soup bowl by spooning soup from that side to the other.”<sup>226</sup>

Despite this kind of persistent advocacy, the biggest challenge was raising the local contributions in a state that, like Texas, was ideologically committed to low taxes and minimal bureaucratic regulation at the state level.<sup>227</sup> The initial federal investment of \$16 million to start work on the C&SF projects, authorized by Congress in July 1948, required a local contribution from the state of Florida of just \$3.25 million.<sup>228</sup> The Citizens Committee on Water Control was convened by outgoing Governor Millard Caldwell to come up with novel strategies to help raise the initial local contribution without raising state taxes.<sup>229</sup> The citizens committee was also clearly focused on promoting the massive project across the state, especially in northern counties not directly affected by the 1947 floods. The state’s malproportioned legislature was a continual hurdle to overcome for unified fundraising efforts. The citizens committee was chaired by State Advertising Commissioner John D. Montgomery, and members included key newspaper editors, state representatives, judges, and business leaders. Because of her success in promoting flood control through the *Miami Herald*, reporter Jeanne Bellamy was asked to be secretary.

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<sup>226</sup> Bellamy, “Taming the Everglades.”

<sup>227</sup> Thomas L Swihart, *Florida’s Water: A Fragile Resource in a Vulnerable State* (Abingdon, UK; New York, NY: RFF Press, 2011), 27.

<sup>228</sup> Godfrey and Catton, *River of Interests*, 33.

<sup>229</sup> “Minutes of the Citizens Committee on Water Control, Orlando Meeting,” November 17, 1948, Jeanne Bellamy Water Resources Collection, HistoryMiami.

Fuller Warren, the incoming governor, addressed the first citizens committee meeting in Orlando in November 1948 and warned members against establishing any new state institution to raise funds. It was a somewhat ironic situation for the new governor. Warren had run with the backing of big business to improve the state's schools and infrastructure. To raise the funds for these improvements, he pushed through the state's first sales tax, overshadowing his next two years as governor.<sup>230</sup> "I hope the committee won't even entertain the idea that a special flood control district should be set up to bear the cost," Warren said.<sup>231</sup> After considering a variety of strategies – such as new gas taxes, legalizing gambling, issuing new state bonds, and raiding the state's unemployment compensation fund – the leadership of the committee soon proposed just such a special flood control district as the only viable solution to raise local contributions in the long run.<sup>232</sup>

Breaking with tradition that had taxed land owners in specific areas in proportion to the benefits they received from drainage projects, the new, regional flood control district would have the power to raise funds from ad valorem property taxes equally in all 15 counties across South Florida. Its reach was far greater than Houston's Flood Control District, which had been confined to a single county. In South Florida, raising funds through county ad valorem taxes was a clear benefit to the large Okeechobee-area farmers to shift the burden of financing flood control to the cities.<sup>233</sup> The citizens

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<sup>230</sup> James C. Clark, *A Concise History of Florida* (Arcadia Publishing Incorporated, 2014).

<sup>231</sup> "Minutes of the Citizens Committee on Water Control, Orlando Meeting," 1.

<sup>232</sup> Richard W. Ervin, "Letter to Jeanne Bellamy," December 17, 1948, Jeanne Bellamy Water Resources Collection, HistoryMiami.

<sup>233</sup> Swihart, *Florida's Water: A Fragile Resource in a Vulnerable State*, 30.

committee pointed out that future economic benefits, such as increasing land values, would rapidly recoup the state's investment in flood control. For the boosters it was a capital investment in the state's growth; an "insurance fund" against future disasters. For Florida's local representatives it was time for their state's own TVA.

Meanwhile in Congress, Senator Holland "meticulously choreographed" a series of hearings to make the case for C&SF Project as essential for South Florida's development and well worth the federal investment. Grunwald argues that Holland was a master of the emerging postwar, pork-barrel politics, and the design of the C&SF Project served many of his most committed special interests such as cattle ranchers in the Kissimmee Valley in central Florida.<sup>234</sup> Yet Holland had been equally committed to Florida's development when he had served as governor during World War Two – luring navy bases to the state, instituting gas taxes to build highways, and stabilizing funding for public education. Although some of the areas protected from floods might have included particular interests, such as central Florida ranchers and farmers, who had supported Holland's political career, his determination to bring in major federal investments and improve infrastructure fit with the senator's commitment to Florida's modernization and growth in the manner of the New Deal in the South.

In 1949, with congressional approval of the C&SF projects at hand, it fell to the Florida state legislature to secure the local contribution so that the Corps of Engineers' construction work could start that year.<sup>235</sup> Even more so than in the case of Houston,

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<sup>234</sup> Grunwald, *The Swamp*, 225.

<sup>235</sup> Jeanne Bellamy, "Letter to Colonel AG Matthews," October 27, 1948, Jeanne Bellamy Water Resources Collection, Box 1, HistoryMiami.

there were multiple interests in South Florida that really needed a single representative: the boosters of the coastal cities, the farmers around Lake Okeechobee and south of Miami in Homestead, and even a few conservationists who were concerned about fish and wildlife. The 1949 legislature created the Central and Southern Florida Flood Control District (C&SF District) to coordinate, operate, and maintain all federal projects in the Okeechobee watershed.<sup>236</sup> It was also empowered to raise funds for these operations.

Unlike previous drainage and flood control districts in the region, the new C&SF District had the authority to maintain infrastructure specifically for water supply and flood control, and its jurisdiction covered a much larger area. Both the Everglades Drainage District and the Okeechobee Flood Control District were replaced by the regional C&SF District headquartered in West Palm Beach. It was a new institution governing water across 17 counties covering a territory of more than fifteen thousand square miles – twice the size of the State of New Jersey. It stretched from the Kissimmee River south of Orlando to the lower Florida Keys, and across the peninsula from the Atlantic to the Gulf of Mexico.

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<sup>236</sup> Godfrey and Catton, *River of Interests*, 33.



*Figure 3.7 Topographic Projection of the C&SF District, 1959. Florida Memory, State Library and Archives of Florida.*

For their initial contribution the state appropriated more than \$3 million, but the annual operating expenses for the C&SF District were to be raised through ad valorem taxes on real estate and personal property within the district's borders. Most of the tax burden fell on the most intensively developed areas near the coast, and it fell especially hard on three cities: West Palm Beach, Fort Lauderdale, and Miami. Dade County alone, with its expensive vacation areas and growing suburbs, was paying for half of the flood control district's costs.<sup>237</sup> Despite this metropolitan burden of responsibility, the board of directors for the C&SF District was appointed by the governor, and most of them came from rural areas of the district. Nevertheless, the first structure to be built was a levee to separate suburban Miami from a water conservation area in the Everglades to the east.<sup>238</sup>

The protection of the suburbs that had flooded three years before was still the first

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<sup>237</sup> Wallis and Dade County Public Works Department, "Water Control in South Florida with Special Reference to Dade County."

<sup>238</sup> Environmental Quality Action Committee, "Drought Briefing - Edited Proceedings" (Greater Miami Chamber of Commerce, June 25, 1971), Jeanne Bellamy Water Resources Collection, HistoryMiami.

priority. For later stages of the project's construction, additional federal funds were to be appropriated in each year's congressional budget, and Dade County planners were concerned that this uncertainty meant the C&SF Project would not be completed as initially planned, leaving parts of Miami without adequate protection from floods and fresh water supplies.

### **Planning the next phase of the C&SF Project, 1952-1960**

Over the next decade the federal government would spend more than \$49 million making sure South Florida would never flood again to the same extent as it did in the summer of 1947. By 1959, estimates for total costs to complete the project had ballooned to more than \$300 million. In both estimated costs and planned regional scale these projects would be at least ten times greater than flood control in Houston. For its part, the state of Florida would pay slightly more than \$9 million for actual construction. The state also paid nearly \$13 million for acquiring rights of way and maintenance.<sup>239</sup> Significant federal and state cost-sharing was an attribute of flood control in South Florida that set it apart from many New Deal-era projects in the West and the larger TVA projects in the Southeast.<sup>240</sup> South Florida's levees produced no electricity to sell and its water

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<sup>239</sup> Joe Koperski to Jeanne Bellamy, "Letter to Jeanne Bellamy," June 16, 1959, Jeanne Bellamy Water Resources Collection, Box 4.6, HistoryMiami. Koperski was chief of the Engineering Division at the Corps of Engineers Jacksonville District.

<sup>240</sup> Charles D. Curran, "A Study of the Central and Southern Florida Flood Control Project Prepared for Senator George A. Smathers" (Legislative Reference Service, October 29, 1953), 20, Jeanne Bellamy Water Resources Collection, Box 4.5, HistoryMiami. In 1953, Florida's contribution was estimated at 39% of the total project costs. For the TVA and Western Reclamation projects in the 1930s, the federal government had covered nearly all of the costs associated directly with flood control. The C&SF projects had a similar kind of cost-sharing to the projects in Houston, where local contributions also reached 40% by the early 1950s.

conservation areas were not a public utility, but Miami and Fort Lauderdale did have land to develop, and property taxes would sustain flood control operations.

In terms of South Florida's postwar growth, regional flood control was extremely effective; developers added hundreds of square miles of new, low-density, single-family home suburbs to Miami, Fort Lauderdale, and West Palm Beach over the next thirty years in formerly flooded areas. The flood control projects were integral to this suburban pattern of development in the area – if not necessarily the powerful draw of people to the Sunshine State. A place in the sun attracted former service members who had experienced the beaches and climate during the war. The denser areas of the coastal cities, such as Miami Beach, had long attracted seniors from the Northeast, and after the war the entire region would be a draw for retirees from expanding demographics and areas of the country. Between the late 1940s and 1960, the combined population of the cities of southeastern Florida more than quadrupled from a little more than 320,000 to 1.3 million people.<sup>241</sup> “South Florida, overrun by young GIs as well as retirees – ‘the newly wed and the nearly dead’ – grew more than twice as fast as the rest of the state.”<sup>242</sup>

Meanwhile, the physical transformations to the Lake Okeechobee watershed continued in the background, beyond the edge of the suburbs and the rapidly disappearing citrus groves and small farms of northern Dade County. By 1950 work had begun on a more than 100-mile-long levee along the East Coast to separate “dry areas” for

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<sup>241</sup> South Florida Regional Planning Council, “South Florida Region Resident Population Estimates and Projections, 1920-2040,” 2012, [http://www.sfrpc.com/Dick's%20Demographics/PopProj\\_SF3.pdf](http://www.sfrpc.com/Dick's%20Demographics/PopProj_SF3.pdf).

<sup>242</sup> Grunwald, *The Swamp*, 229.



development from “wet areas” for flood control and water conservation.<sup>243</sup> The water conservation areas were essentially large, permanently flooded reservoirs that were contained by levees and canals. During periods of abundant rainfall, pumping stations could refill the conservation areas from canals and drainage channels on the dry side of the levee. The water conservation areas could then act as reservoirs for agricultural uses, or more crucially, as high pressure caps to keep salt water from infiltrating the Biscayne Aquifer and ruining municipal wells.

Everglades land devoted to water conservation was thus unusable, and the location and size of these areas had to be renegotiated several times. For example, the Florida Seminole Tribe governed reservation land and kept cattle on many of the wet prairies that were to be permanently flooded for water conservation. Other ranchers and farmers nearby wanted more land to be set aside for agriculture. Wildlife conservationists and sportsmen’s associations campaigned for the most northern Water Conservation Area #1, in Palm Beach County, to be managed as a wildlife refuge. All these factors resulted in the water conservation areas being significantly smaller than originally planned. The reduction in area meant that fresh surface water could not be used as extensively as a cap to prevent Atlantic salt water from getting into groundwater supplies. As the coastal cities grew, contamination and draining of the Biscayne Aquifer would lead to persistent concerns about fresh water supplies in South Florida.

As the challenges of building the extensive network of canals, levees, and pumping stations became apparent, construction delays set in. Requests for congressional

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<sup>243</sup> Environmental Quality Action Committee, “Drought Briefing.”

appropriations increased. The project needed at least \$5 million a year to stay on track, but in 1950 and 1951 it only got a fourth of that amount. By 1953 the estimated costs to fully complete the whole C&SF Project rose by 65 percent – from the \$70 million that had been authorized in 1948 to over \$116 million. First-term Senator George Smathers was particularly interested in reviewing the process of civil works authorizations and the delays in the C&SF Project.<sup>244</sup> A report he requested claimed that the jump in the project's costs was to blame partly on "price rises" but to a greater extent on "size increases in elements of the project."<sup>245</sup>

Even with the first phase still incomplete, a long series of levees ran for nearly 100 miles down the east coast of Florida from the south end of Lake Okeechobee to near Homestead.<sup>246</sup> The network of drainage canals had been extended so that water from the Everglades could be shunted rapidly into the Atlantic Ocean. The seasonal wetlands were now confined west of the coastal levee. Older Miami suburbs such as Hialeah and Coral Gables could expand westward towards the levee, and new suburbs such as Miramar, near Fort Lauderdale, and Boca Raton, south of Palm Beach, were planned for areas of former wetlands and scrub pines. New construction projects were required by county

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<sup>244</sup> Senator Smathers had defeated the incumbent Claude Pepper in the dramatic 1950 Florida Democratic primary. It was a local battle as Cold War tensions continued to increase. Smathers was a committed "Truman man", and Pepper had been not been particularly supportive of Truman's Democratic nomination in 1948. Pepper did make supportive statements, however, about some of the Soviet Union's social policies. Smathers campaigned as an anticommunist. He was a personal friend of Jack Kennedy, who had the adjacent office when they had served in the House of Representatives in 1948. Kennedy, whose family had a winter home in Palm Beach, was supportive of major civil works projects in Florida throughout his political career.

<sup>245</sup> Curran, "A Study of the Central and Southern Florida Flood Control Project," 11. "Price increases" included the cost of buying land, rights-of-way, and "relocations". Most of these expenses were supposed to be the responsibility of the State of Florida and the C&SF District.

<sup>246</sup> Godfrey and Catton, *River of Interests*, 45.

ordinance to connect their drainage to the network of canals and to meet minimum ground-level requirements.<sup>247</sup> Building sites were literally “built up” while the water was held back, diverted, and pumped away. When flood conditions returned again in the summer of 1953, these regulations and early protective works built for the C&SF Project kept the driveways of the new suburban bungalows dry.

Meanwhile, the scope of flood control was expanding north of Lake Okeechobee and into the meandering valley of the Kissimmee River, south of Orlando. Agricultural interests in central Florida pushed to expedite a second phase of the C&SF Project that would control flooding in the Kissimmee River basin and also provide a steadier supply of water to the farms south of the lake. Not only would this second stage of the project control flooding in central Florida, it would also allow for Lake Okeechobee itself to be a reservoir for fresh water to meet increased agricultural and urban water usage. As Lamar Johnson, the chief engineer for the C&SF District, testified at a Corps of Engineers hearing that year on phase two of the project, “Partly because of the promise of the protection to result from the construction of the flood control project, land development and use have outstripped the progress of the construction program. Therefore, the need for Lake control today is greater than when the flood control project was authorized.”<sup>248</sup>

The water levels in the conservation areas had to be maintained at precise levels. Too much water, and the risk of flooding was increased. Too little water, and agricultural

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<sup>247</sup> Wallis and Dade County Public Works Department, “Water Control in South Florida with Special Reference to Dade County,” 13.

<sup>248</sup> Lamar Johnson, “Letter to District Engineer on the Regulation of Lake Okeechobee via St. Lucie Canal and Caloosahatchee River,” December 18, 1953, Jeanne Bellamy Water Resources Collection, Box 6.12, HistoryMiami. Johnson was chief engineer of the C&SF District which operated the water conservation areas and the pumping stations but did not control the level of water in Lake Okeechobee, which remained under the authority of the Corps’ Jacksonville District.

and urban water supply shortages would result. This fragile balance made it hard to factor in the best water level for fish and wildlife as well. The Everglades National Park did not get enough water during dry years, and some rivers treasured by sportsmen, such as the St. Lucie River in Martin County, were flushed out with runoff in years with abundant water.<sup>249</sup> The Corps of Engineers seemed to be prioritizing some interests over others as they brought the early phases of the C&SF Project to completion in the 1950s. Suburban flood control and water supply were above the interests of Everglades National Park and the new Loxahatchee Wildlife Refuge that had been established in the northernmost water conservation area.<sup>250</sup> Meanwhile, salt water intrusion was an increasing concern as Dade County continued to grow rapidly in the 1950s and contributed an increasing percentage of the ad valorem taxes that maintained C&SF operations. Between 1949 and 1952, Dade County's taxes added up to over \$2 million, or 67 percent of the C&SF District's total assessed levies.<sup>251</sup> For Dade County

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<sup>249</sup> Johnson, 5; Jenny Staletovich, "Lake Okeechobee: A Time Warp for Polluted Water," *Miami Herald*, August 13, 2016, <http://www.miamiherald.com/news/local/environment/article95442427.html>. This central dynamic has remained a recurring problem, and unintended consequence, of the "plumbing" provided by the C&SF Project to this day. The Everglades themselves were able to handle and filter high water levels, and the grassy marshes naturally burned during droughts. All this was part of the natural cycle that did not fit well with keeping water away from the cities and retaining some for use during droughts. As Everglades Restoration projects attempt to mimic some of this original pattern, they continue to struggle with providing enough water to the National Park, and conversely with too much nutrient-filled runoff ruining rivers and causing algae blooms along the coastline. Florida Governor Rick Scott has blamed the federal government for this coastal pollution.

<sup>250</sup> Godfrey and Catton, *River of Interests*.

<sup>251</sup> HW Schull, "Letter to Jeanne Bellamy," February 11, 1954, HistoryMiami, Jeanne Bellamy Water Resources Collection. In the list of county taxes for the C&SF District for 1953, provided by Jacksonville District Engineer Col. HW Schull to Jeanne Bellamy, Miami's Dade County's assessed property is worth over \$1 billion. At only one-mill, it was not a particularly significant property tax. But Dade county's assessed value was four times greater than the next largest contributor, Fr. Lauderdale's Broward County, with only \$237 million in assessed property value. In term of sustaining the C&SF District, and driving growth in South Florida, Miami and its suburbs were the key engine in the 1950s.

representatives, the politics were clear: If Miami was going to be paying for the system, why were their municipal water supplies not the first priority?

After repeated concerns from Florida's representatives in Congress that the later phases of the C&SF project would not be completed because of inadequate appropriations, the Flood Control Act of 1954 authorized the entire C&SF budget. The uncertainty over annual congressional appropriations came to end, at least for the next decade. The estimate for local contributions rose to nearly \$29 million, or 39 percent of the total.<sup>252</sup>

In the 1950s, the unincorporated suburban areas of Dade County, such as Kendall, were growing rapidly. Small towns, such as Hialeah, were also booming. All this growth left behind the increasingly cash-strapped city of Miami itself. Dade County struggled to provide services across large areas that had been sparsely populated citrus groves before the war. City and county commissioners proposed a metropolitan form of government in the early 1950s. At the time, it was a novel solution to these demographic shifts and management challenges. Voters approved the new government structure in 1957.<sup>253</sup> "Miami-Dade" was the first city-county, cost-sharing metropolitan government in the country. Miami's struggles with suburban fragmentation were not unique, as central-city business interests started to erode in the 1950s. Miami and Atlanta saw these demographic shifts outside of city borders, but other sunbelt cities such as Houston and

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<sup>252</sup> Curran, "A Study of the Central and Southern Florida Flood Control Project."

<sup>253</sup> Mohl, "Miami: The Ethnic Cauldron."

Phoenix annexed many surrounding areas, reinforcing the sprawling central city.<sup>254</sup>

Miami-Dade County found a governing balance between these interests.<sup>255</sup> After 1957, the metro government took over responsibility for building codes, water supplies, sewer and drainage, shoreline protection, and recreational facilities.

Flood control was still a priority, but concerns about long-term fresh water supplies were starting to become most prominent. In 1958, Miami-Dade County's Public Works Department released a report on "Water Control in South Florida" that sought to justify further work on the C&SF Project in Dade County in terms of benefits to the water supply.<sup>256</sup> The report, written by Turner Wallis who had been the first chief engineer of the C&SF District, prioritized the "stabilization and insured future adequacy" of fresh water supplies as a justification for modifying the original C&SF designs.<sup>257</sup> Wallis' report for Miami-Dade County Public Works also noted that urban development was a particular benefit for Dade County that warranted a modification of the original Corps of Engineers' plans.

Suburbs and farms in the most low-lying, southern areas of Dade County needed more than just canals to avoid flooding. The original plans for the C&SF Project had just specified the levees along the east coast and two main drainage canals to protect this suburban area around Homestead that was still largely rural in 1948. But with the rapid

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<sup>254</sup> R. M. Bernard and B. R. Rice, "Introduction," in *Sunbelt Cities: Politics and Growth since World War II*, ed. R. M. Bernard and B. R. Rice (University of Texas Press, 1983), <http://books.google.com/books?id=Bie5AAAAIAAJ>.

<sup>255</sup> The Atlanta Regional Commission was another, albeit weaker, solution to a similar set of problems. See: Hardy, "Policy Drought: Water Resource Management, Urban Growth, and Technological Solutions in Post-World War II Atlanta."

<sup>256</sup> Wallis and Dade County Public Works Department, "Water Control in South Florida with Special Reference to Dade County."

<sup>257</sup> Wallis and Dade County Public Works Department.

growth of the Miami area, and perhaps a growing confidence in the reality of flood control, new planned communities were cut out of the pines, orchards, and desiccated wetlands. By 1952, thousands of new, affordable concrete-block-on-concrete-slab homes, with screened-in Florida rooms and carports, were a reality in south Dade.<sup>258</sup>

To protect the newly developed areas of south Dade, the Corps of Engineers developed a supplementary plan for the C&SF Project that included four large pumping stations to move excess water in suburban Dade County uphill, past the east coast levee, and into the water conservation areas. Turner Wallis accused the Corps of Engineers of being reluctant to actually approve this supplementary plan with its expensive pumping stations because that would substantially increase the costs of completing the C&SF Project. Instead the Corps of Engineers demanded new studies of drainage patterns and land usage before sending the supplementary plans to Congress for approval.

### The Waters of Destiny

During this period, the Corps of Engineers and the C&SF District also sponsored a film promoting the flood control projects in South Florida. Comprised of documentary footage, and narrated in the supremely melodramatic, public service style of the late 1950s, the film was titled *Waters of Destiny*.<sup>259</sup> It was a turning point for the C&SF projects; a moment to capture the transformative changes underway in South Florida. In

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<sup>258</sup> Allan Shulman and Jean-François Lejeune, "Florida Home: Modern Living, 1945-1965," HistoryMiami, 2005, [http://historymiamiarchives.org/online-exhibits/florida\\_home/florida\\_home\\_essay.htm](http://historymiamiarchives.org/online-exhibits/florida_home/florida_home_essay.htm). Interestingly, many of these homes did not have central air conditioning before 1960. Early 1950s modernist Florida ranch homes had to be cooled through ventilation, fans, and proper orientation towards prevailing breezes. Concrete-slab construction made them cheaper, but it removed the traditional method of cooling through raised wooden floors above a ventilated crawlspace.

<sup>259</sup> State Library and Archives of Florida, "Waters of Destiny," Florida Memory, accessed September 11, 2017, <https://www.floridamemory.com/items/show/232410>.

Michael Grunwald's view, *Waters of Destiny* conveyed the ultimate engineering hubris. It made a clear statement of man's "mastery" over nature that ignored everything that made South Florida unique.<sup>260</sup> But the film also captured many of the real sentiments of politicians and boosters who had pushed for such a large-scale response to the 1947 floods. To a large extent this was the narrative Florida's politicians had been trying to sell to the nation, and the 1950s was a moment when Florida's spectacular growth seemed to fulfill what had been promised.

*Waters of Destiny* was aptly named. It made the case that the C&SF projects were finally helping South Florida live up to its destiny as something more substantial than just a winter vacation destination. The film extolled the damages prevented by flood control, and then the narration turned to Florida's 1950s boom. "When you get past the saving, think of the making," it intoned. "The livestock industry for instance, growing even more fantastically since the project was started, is contributing considerably to the assets of the area. So is industry, by millions each year. More tourists have come, cities have grown, sport has been better than ever, families safer than ever."

Most importantly, the film called for the completion of the C&SF Project Plan as a way for Florida to fulfill its destiny to the nation as a whole:

"Flood control must proceed, as fast as humanly possible so that everyone, not only in just this 15,000 square miles of land, but everyone, everywhere, can share in the rich results of man's mastery of the elements. Then it shall be that water, once the fierce, uncompromising enemy of this long, wide, low-lying land, will become its greatest ally. The rains may come, but there will be no fear in them. They are the waters of Florida's unfolding destiny, the bright promise of Florida's glowing future."

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<sup>260</sup> Grunwald, *The Swamp*, 221.



In the spring of 1960, the successful narrative of *Waters of Destiny* received its first test from the elements. Starting in March that year a series of major storms crossed the lower Florida peninsula. The potential for large-scale flooding was largely controlled, however, by the C&SF works already in place. Water conservation areas filled and canals shunted excess flood waters to the Atlantic and the Gulf. While there was some flooding in the rural areas of Palm Beach and Broward counties, the Corps of Engineers estimated that nearly \$28 million in flood damages were prevented by the systems partially in place.<sup>261</sup>

Total benefits, in terms of property damage prevented, between 1949 and 1961 was more than \$84 million. This was greater than all the money that had been spent on construction costs to that point.<sup>262</sup> In the early 1960s, flood control was justified by the C&SF District as an unmitigated success: over the next fifty years it was projected to return four times the amount of benefits for the costs. As *Waters of Destiny* had proclaimed, “The work goes on, the drilling, the digging, the placing, the forming with the sure and complete knowledge that every dollar, every man hour of labor, will be repaid several times over.”

### **Chapter summary**

Extensive suburban and rural flooding throughout South Florida could not have come at a better time than in the summer of 1947. Postwar growth was creating another housing boom in South Florida, and it was empowering major civil works projects around the country. And in contrast to Houston, Miami politicians and boosters were successful

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<sup>261</sup> Huser, Kirchhoff, and Nicholas, *Into the Fifth Decade: The First Forty Years of the South Florida Water Management District, 1949-1989*, 25.

<sup>262</sup> Beginning in the 1990s, the need for Everglades Restoration would sharply alter the cost-benefit estimates made after the flood of 1960.

in linking suburban flooding to the development of the state as a whole. Florida's unique geography helped in this regard, since the same floodwaters that damaged crops around Lake Okeechobee also cutoff suburban homes in Dade County 80 miles away.

The comprehensive flood control projects were rapidly studied by the Corps of Engineers and authorized by Congress practically overnight, compared to the usual pace of these deliberations. The state of Florida stepped through with initial funding. Despite delayed appropriations from Congress, planning and construction of the first levees and canals also proceeded quickly so that major impacts from floods in 1953 and again in 1960 were largely prevented.

During the 1950s, South Florida continued to boom, and the memory of flooding started to fade, while property taxes covered the costs of operating the extensive water management system out of sight. As in Houston, by the late 1960s, a strengthening environmental movement and budget cuts would stall the system's completion. Meanwhile, in the nearby Tampa Bay area, those storms of 1960 would be far more damaging and would inspire another round of flood control projects on the Gulf Coast of Florida.

## **CHAPTER 4**

### **TAMPA, THE FOUR RIVER BASINS, AND WATER MANAGEMENT, 1960-1981**

Compared to downtown Houston and suburban Miami, flood control in Tampa was a more rural, and far more controversial, project from the start. Flood control in Houston was a New Deal endeavor meant to protect a core city's downtown and port. The massive postwar water management systems in South Florida permanently reclaimed large areas of the Everglades for suburban growth. In the 1960s the hills, rivers, and wetlands around Tampa were still mostly rural. Flood control was meant to primarily protect citrus farmers and cattle ranchers. In contrast to the flood control projects in Miami and Houston, Tampa represents a case where most of the infrastructure designed by the Corps of Engineers in the early 1960s was never completed. A critical overflow canal to protect the city of Tampa itself from flooding on the Hillsborough River was finished in 1981, and some smaller canals and a reservoir in rural areas of central Florida were also built, but ninety percent of the federal works were shelved in the 1970s.

During that transformational decade both environmental concerns and budgetary constraints ultimately forced a change in strategy. Instead of relying on a structural system of canals and reservoirs, the Southwest Florida Water Management District (SWFWMD) acquired land in floodplains and regulated nearby development to successfully control flooding. Attempts by water managers to regulate access to fresh water supplies in a rapidly-changing region were less successful.

The case of unrealized flood control projects in Tampa also represents a starker version of what eventually happened in both Houston and Miami in the 1970s. In both of those cities environmental concerns and shrinking budgets halted the Corps of Engineers' plans for more structures, such as concrete-lined bayous in the suburbs of Houston and more canals in the Everglades. As in Tampa, Harris County authorities chose to acquire land and create nature parks and recreation areas for "nonstructural" flood control in Houston. In Miami, the Corps of Engineers began to alter its mission dramatically from trying to control nature to restoring wetland ecosystems, and thus to protecting water quality and recreational resources in South Florida for the long run.

### **The Landscape of the Tampa Bay Area**

Tampa Bay is Florida's best natural, protected harbor on the Gulf Coast. In contrast to the flat topography of both Houston and Miami, there is hilly terrain within a few miles of the estuary shore. Native American and later Spanish exploration and colonization in the region dates back centuries, but permanent American settlement began in 1824 with the establishment of Fort Brooke at the mouth of the Hillsborough River.<sup>263</sup> With its municipal incorporation in the decade before the Civil War, Tampa is actually only slightly younger than Houston, and a much older city than Miami, but the federal flood control projects in the Tampa Bay area were started most recently.

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<sup>263</sup> Canter Brown, *Tampa before the Civil War*, Tampa Bay History Center Reference Library Series, no. 8 (Tampa, FL: University of Tampa Press, 1999), 31.



*Figure 4.1 Cummer Sons Cypress Company Engine 104 in the Green Swamp, 1939. Florida Memory.*

The Hillsborough River meanders south into Tampa Bay from a large, elevated area of wetlands called the Green Swamp on the central Florida plateau. Green Swamp was never drained and the area was only sparsely settled. Huge stands of cypress trees in the wetlands were logged extensively in the 1920s, and the surrounding area had a few citrus farms and cattle ranches. Green Swamp, located mostly in Polk County, is the headwaters of Southwest Florida's four main rivers: the Hillsborough, Withlacoochee, Peace, and Ocklawaha. Crucially the swamp is also the main recharge area for the *Floridan Aquifer* which supplies fresh water to much of the region through a system of

wellfields. The Floridan Aquifer is the source of 60 percent of the entire state's groundwater.<sup>264</sup>

The last major hurricane to hit the Tampa area during the twentieth century occurred in 1921. It caused extensive damage to St. Petersburg's waterfront, and it flooded expensive homes in Tampa's wealthy Bayshore and Hyde Park neighborhoods along Hillsborough Bay. As with the 1926 Miami hurricane a few years later, however, the storm did not stop local developers and their allies from pursuing opportunities in the Great Florida Land Boom. They emphasized rapid rebuilding and downplayed future risks.<sup>265</sup> The last hurricane of any size to come ashore in Tampa Bay was in 1946 and resulted in little damage. Neither the 1921 or 1946 storms inspired concerted efforts by local governments to secure protective infrastructure.

Tampa's protected location near the Caribbean and Latin America made it an important port in the early twentieth century. By the 1880's Tampa had been connected by rail to Jacksonville, creating a shortcut across the Florida peninsula. The Port of Tampa was long a critical shipping center for Florida lumber and cattle to Cuba, and the discovery of phosphate in Southwest Florida made it also a key producer of fertilizer for the entire Caribbean.<sup>266</sup> Meanwhile by the 1920's Cuban immigrants to Tampa had developed the world's largest cigar manufacturing center, and cigars became another

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<sup>264</sup> Richard L. Marella, "Water Use in Florida, 2005 and Trends 1950–2005," US Geological Survey, 2008, <https://pubs.usgs.gov/fs/2008/3080/>.

<sup>265</sup> Eric Jarvis, "'Secrecy Has No Excuse': The Florida Land Boom, Tourism, and the 1926 Smallpox Epidemic in Tampa and Miami," *The Florida Historical Quarterly* 89, no. 3 (2011): 320–46.

<sup>266</sup> Port Tampa Bay, "Location and History of Port Tampa Bay," accessed June 2, 2016, <https://www.tampaport.com/about-port-tampa-bay/about-port-tampa-bay/history.aspx>.

major Tampa export.<sup>267</sup> Although the Great Depression was hard on the cigar industry, the Second World War reinvigorated the Tampa Bay area by bringing two large ship-building facilities to the Port of Tampa and the construction of MacDill Airbase for the Army Air Force.<sup>268</sup> Thousands of pilots and support personnel trained in Tampa during the war. After the war, a Central Florida commodity rapidly became a staple of American breakfasts: orange juice. In 1948, annual citrus production in Florida was more than half of the total in the United States, at nearly 100 million boxes. Production in Florida continued to outpace California and Texas, with more than 66 percent of the US total coming from Florida's 550,000 acres of citrus groves by 1960.<sup>269</sup>

Postwar growth greatly expanded cities on both sides of Tampa Bay, although not as dramatically as the growth of the Miami area during the same period. The city of Tampa's population more than doubled between 1940 and 1960, to more than 250,000 residents.<sup>270</sup> Hillsborough County, on the east side of the Bay surrounding the city of Tampa, also doubled its population to almost 400,000. St. Petersburg tripled its size during the same period to around 180,000. The narrow peninsula of Pinellas County, sandwiched between the west side of Tampa Bay and the Gulf of Mexico, including the city of St. Petersburg, became the most densely populated county in Florida during the same period, quadrupling its total population to 375,000. As in Miami, many of the new

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<sup>267</sup> Durward Long, "The Historical Beginnings of Ybor City and Modern Tampa," *The Florida Historical Quarterly* 45, no. 1 (1966): 31–44.

<sup>268</sup> Gary R. Mormino, "World War II," in *The New History of Florida*, ed. Michael Gannon (University Press of Florida Tallahassee, FL, 1996).

<sup>269</sup> Agricultural Marketing Service, "13th Annual Citrus Statistical Summary" (US Department of Agriculture, March 1961), [https://www.nass.usda.gov/Statistics\\_by\\_State/Florida/Publications/Citrus/](https://www.nass.usda.gov/Statistics_by_State/Florida/Publications/Citrus/).

<sup>270</sup> US Census Bureau, "Census of Population and Housing."

residents of Pinellas County were retirees from the North. New suburbs of Tampa such as Temple Terrace, which had been little more than an aspiration during the land boom of the 1920's, became home to the new University of South Florida and nearly four thousand residents by 1960. Immediately north of Hillsborough county was the still-mostly rural areas of Pasco and Hernando counties, home to large ranching operations and citrus groves.

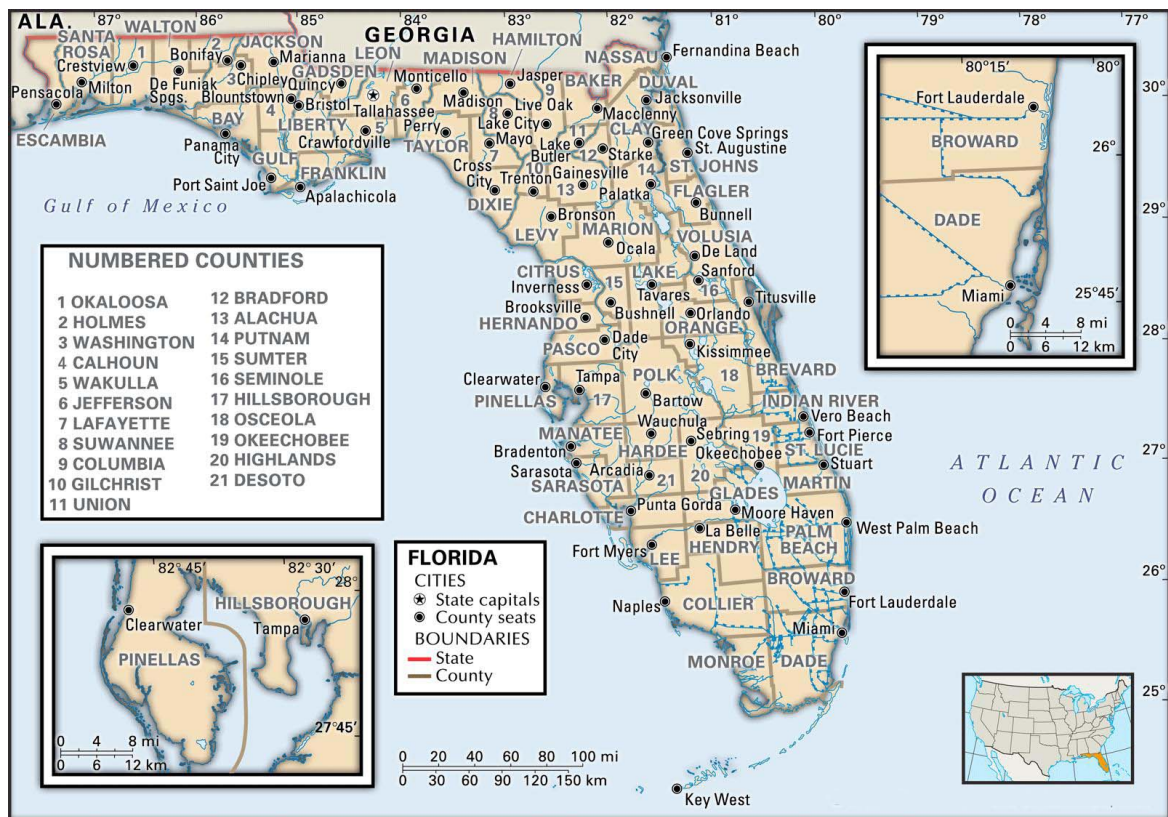


Figure 4.2 Map of Florida Counties with Tampa Bay Area inset, University of Florida Libraries

### The Floods of 1959 and 1960

The suburbs of Tampa first experienced flooding in August, 1959. Forest Hills, near Temple Terrace, was another planned suburb of the 1920's land boom that never



saw much home construction until the early 1950s.<sup>271</sup> Its main feature was an aging golf course and country club surrounded by many local, spring-fed lakes. The summer of 1959 had been unusually wet, even for Florida's "rainy season", and the Corps of Engineers had been evacuating water from Lake Okeechobee to prevent flooding in South Florida. After another series of large rainstorms passed through the Tampa Area, the water table was already high, and lakes which normally drained through limestone sinkholes into the aquifer below overflowed. In Forest Hills ninety homes flooded, and 300 acres were underwater.<sup>272</sup> The Red Cross setup shelters, and fears of a typhoid fever outbreak sparked a mass vaccination campaign.<sup>273</sup>

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<sup>271</sup> Rodney Kite-Powell, "Forest Hills Was Tampa's Overlooked Boom-Time Neighborhood," TBO.com, July 28, 2013, <http://www.tbo.com/events/forest-hills-was-tampas-overlooked-boom-time-neighborhood-20130728/>.

<sup>272</sup> Charles R. Ford, "Memo on Flood Reconnaissance, Forest Hills Area, Tampa, Fla. 20-21 August, 1959," August 26, 1959, Box 9, Accession No. 077-96-0017, RG 77, National Archives at Atlanta.

<sup>273</sup> "Flooded Tampa Set for Typhoid Shots," *St. Petersburg Times*, August 18, 1959, Google News Archive, <https://news.google.com/newspapers?nid=feST4K8J0scC>.



*Figure 4.3 Corps of Engineers Flood survey in the Tampa suburb of Forest Hills, 1959. Records of the Jacksonville District, US Army Corps of Engineers, National Archives at Atlanta.*

The following year, flooding went from being a local emergency to a regional catastrophe. In March 1960 a series of spring storms inundated much of southwest Florida. The Gulf Coast and central region of the state received 27 inches of rain over four days. The US Army Corps of Engineers noted this was representative of the 40-year flood event in the region. Quiet, spring-fed rivers became raging torrents across much of Central Florida. The Hillsborough River brought floodwaters directly into the suburbs of Tampa. Water flowed in the front doors of new midcentury homes in Temple Terrace, and orange groves in rural areas of Hillsborough County were ruined.<sup>274</sup> In the Everglades south of Lake Okeechobee, flooding from the same storms was even more

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<sup>274</sup> John Rasor, "Damage in West Coast Floods May Hit Total of \$10,500,000," *Tampa Tribune*, August 1960, Box 9, Accession No. 077-96-0017, RG 77, National Archives at Atlanta.

extensive, but the new Central and Southern Florida (C&SF) flood control projects largely kept the east coast cities dry.<sup>275</sup>

Perhaps these storms alone would not have been enough to catalyze a push for regional flood control in the Tampa area, but they were followed by a powerful hurricane several months later. In September Hurricane Donna made landfall just south of Sarasota and crossed the state, drenching much of central Florida before eventually causing extensive damage along the mid-Atlantic coast. Donna did not come ashore in Tampa Bay itself, and Tampa and St. Petersburg were saved from coastal storm damage, but the hurricane led to another round of flooding on the rivers of central Florida. This second calamity in a six-month period forced disparate local interests from urban and rural areas finally to unite behind the need for a federal project like the one that had protected the Miami area in the previous decade.



*Figure 4.4 Flooding at Masaryktown, 1960. SWFWMD Water Matters Magazine, 2011*

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<sup>275</sup> Huser, Kirchhoff, and Nicholas, *Into the Fifth Decade: The First Forty Years of the South Florida Water Management District, 1949-1989*, 25.

Rural interests were the first drivers of the projects in Southwest Florida. Small farmers were wiped out by the repeated floods of 1960. The destruction of poultry farms in Masaryktown, a tiny farming village forty miles north of Tampa, just on the edge of Hernando County, became the symbol for regional flood control. Masaryktown had been founded by Czech immigrants in the 1920s.<sup>276</sup> The settlers had attempted to plant citrus groves, but frosts had killed their early crops. Most of the few hundred families gave up and moved elsewhere, but some stayed and started raising chickens. By the 1950s, the family-run poultry industry in Masaryktown was the largest in Florida, which was rapidly becoming a chicken-exporting state. Many retirees had also joined the aging original Czech settlers. Dale Twachtman, who served as the second Executive Director of the Southwest Florida Water Management District (SWFWMD) from 1962 to 1972, recalled the damage to the poultry industry. “The District was formed as a result of Donna,” Twachtman said. “It was a real crisis. In Masaryktown, people lost their homes and their businesses. Farmland was underwater. Tens of thousands of chickens drowned during the hurricane.”<sup>277</sup>

Remarkably, it would be 25 years before another major hurricane would even threaten the Tampa Bay area. Instead, the region was next ravaged by a prolonged drought, which started in 1961 and lasted until late 1962, and water shortages became a more immediate context for infrastructure in the region. As was the case in Miami, flood control had to be intimately tied to securing fresh water supplies for agriculture and

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<sup>276</sup> Dewey M. Stowers Jr and Harry J. Schaleman Jr, “Masaryktown: A Successful Ethnic Experiment,” *The Florida Geographer* 16 (1982).

<sup>277</sup> Southwest Florida Water Management District, “The 1960s — The District’s Beginning,” *WaterMatters Magazine*, October 2011, <https://www.swfwmd.state.fl.us/documents/publications/watermatters/oct-2011/1.html>.

growing cities. “People were asking me why we were spending all this money on flood control when their problem was a lack of rain,” said SWFWMD Director Twachtmann. “The problem at that time was drought, not flooding.”<sup>278</sup>

There were few effective responses available to local authorities. County commissioners could not coordinate regulations on groundwater usage across the region. City-based utilities, especially booming St. Petersburg, focused on ensuring steady supplies to their growing number of users. Planners in Hillsborough and Pinellas counties did respond to the drought, however, by launching a major effort to understand land use, water supply, water usage, and future population growth in the Tampa Bay region as a whole. Planners were especially interested in learning more about the impacts of increased demand on groundwater levels. Much of this data had never before been compiled regionally when the aquifers seemed like a limitless resource.

On the state level, the legislature created a fund to acquire land for “conservation and recreation.”<sup>279</sup> Flood control and water supply were the underlying factors motivating land purchases through the fund.<sup>280</sup> As in much of the country, reservoirs were becoming sites for recreation, paid for by local recreation bonds and state taxes. Land values had been increasing dramatically in the 1950’s across the state, and parts of the C&SF project were becoming far more costly. The new state fund could be used by local authorities across Florida to acquire land that would be useful for water projects. It was financed by

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<sup>278</sup> Southwest Florida Water Management District.

<sup>279</sup> James A. Farr and Greg O. Brock, “Acquisition History,” Florida Department of Environmental Protection, accessed November 15, 2016, <http://www.dep.state.fl.us/lands/AcqHistory.htm>.

<sup>280</sup> “Minutes of the Tampa Bay Region Study Advisory Committee,” August 16, 1963, Box 2, Accession No. 077-02-0045, RG 77, National Archives at Atlanta.

a 5 percent sales tax on “outdoor clothing and equipment”, which was really targeting bathing suits. The “bathing suit tax” ended up being rather unpopular, and in 1964 it was replaced by recreation bonds financed by taxes on real estate transactions.

Most importantly, in the counties that had been impacted by the 1960 floods, the state created a new flood control district with an explicit, multi-purpose “water management” mission. Founded in 1961, the SWFWMD would try to strike a different balance from the Central and Southern Florida (C&SF) Flood Control District that was already facing political and environmental challenges. Like the C&SF Flood Control District, the new Water Management District was run by a Board of Governors appointed by the Governor of Florida, but in a move to decentralize some of the policymaking, the SWFWMD had 11 separate “basin boards” that were each responsible for a single watershed.

This decentralization was in part because of rivalries between more urbanized Pinellas County and the rural counties north of Tampa. State Senator C.W. Young, who hailed from a suburb of St. Petersburg, had opposed the creation of the SWFWMD because he felt the tax burden would fall mostly on Pinellas County and its thousands of new retirees. Most of the benefits would end up on the other side of Tampa Bay.<sup>281</sup> Likewise, the rural counties did not want to shoulder a disproportionate share of the burden of fixing the flood problems in Tampa’s suburbs. These tensions between St. Petersburg, Tampa, their suburbs, and the rural counties around Tampa would haunt the Water Management District for the next two decades. To get around the issue in 1961,

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<sup>281</sup> Frank Noel, *Senator Connor Voicing His Support for the Southwest Florida Water Management District Project - Tallahassee, Florida*, 1961, Black & white photoprint, 1961, Florida Memory, State Archives of Florida.

the basin boards were given 25 percent of the ad-valorem tax revenues collected by the SWFWMD for their own, smaller projects on the rivers in that watershed.

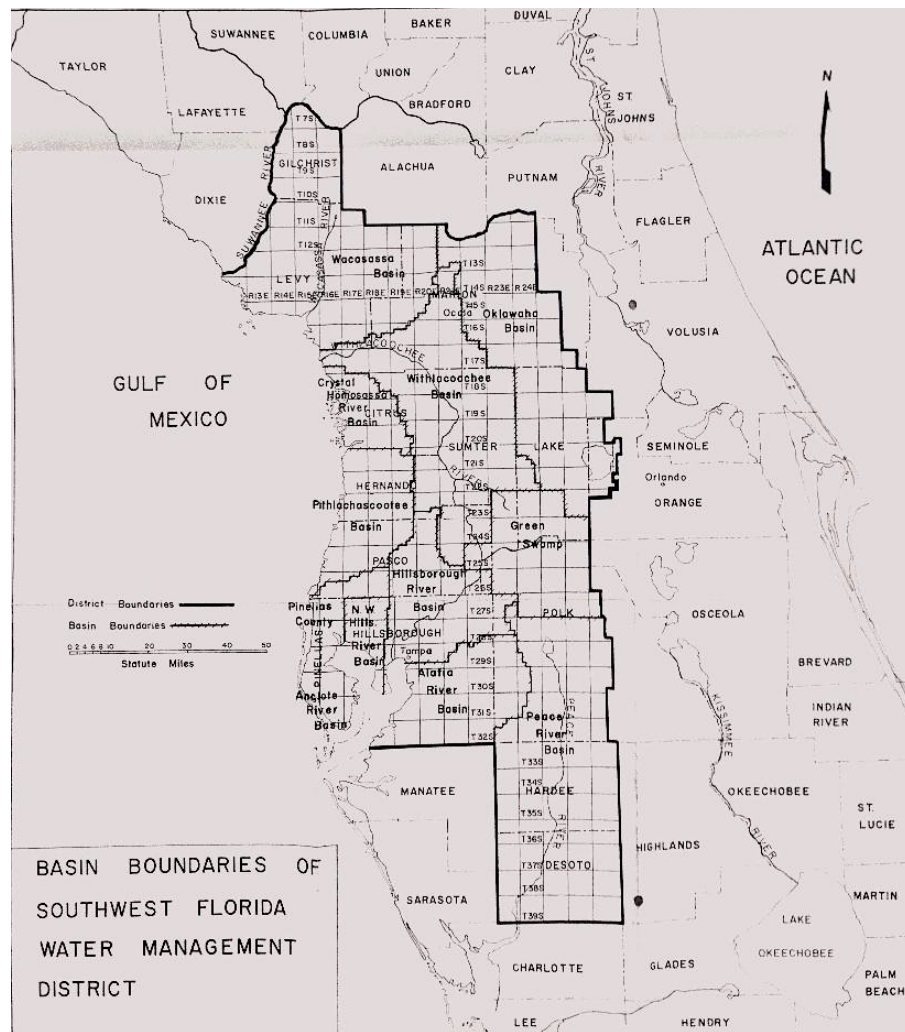


Figure 4.5 Counties and basins in the SWFWMD, 1961. Records of the Jacksonville District, US Army Corps of Engineers, National Archives at Atlanta.

Alfred McKethan, a long-time banker and developer in the ranching and farming town of Brooksville, which had been at the center of the 1960 floods, was appointed by Governor Farris Bryant as the first Chair of the SWFWMD Board of Governors. The other board members were also landowners in central Florida, many of them involved in

citrus growing.<sup>282</sup> The first headquarters of the new Water Management District was only a couple blocks away from McKethan's bank in Brooksville. The payroll account was deposited there as well. McKethan had been chairman of the State Road Board under Governor Fuller Warren who had championed the C&SF District in the late 1940s. In 1961 McKethan was the president of the Florida Banker's Association, and had close ties to newly-elected Governor Bryant and the "Pork Chop Gang" – the conservative coalition of Democrats from small, northern Florida counties that controlled much of state politics in the 1950s. Brooksville was the seat of Hernando County, and although its population was small, its state representatives were committed to defending a traditional vision of rural life in Florida.



*Figure 4.6 Dale Twachtmann, The Tampa Times, 1972*

McKethan hired Dale Twachtmann as the district's third employee and the first with any engineering background. Twachtmann studied civil engineering at Iowa State University, became interested in hydrology, and served in the Air Force for four years before moving to Tampa in 1959. He worked in his father-in-law's construction business

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<sup>282</sup> Dale Twachtmann, Interview with Dale Twachtmann on Water Management, interview by Julian Pleasants, Transcript, February 20, 2006, 2, Samuel Proctor Oral History Program, University of Florida Libraries, <http://ufdc.ufl.edu/AA00020192/00001/citation>.



in Tampa, but remembered that it “wasn’t the kind of work I wanted to do.”<sup>283</sup> When Twachtmann heard about the founding of the SWFWMD in 1961, he drove up to Brooksville and inquired about a job. Four months later he was acting Executive Director, as the first board member who had taken that position left to run the Democratic Party’s office in Manatee County.<sup>284</sup> Despite that very informal start, Twachtmann would serve the Water Management District as Executive Director from 1962-1972. He would go on to direct Tampa’s water utilities in the 1970s and eventually he would become Secretary of the state’s Department of Environmental Regulation.

During his tenure as Executive Director of the SWFWMD, Twachtmann would become a symbol for the expensive, domineering approach to large, structural water management that was rapidly becoming untenable for the flood control projects in both Miami and Tampa. “I had the engineering psyche,” Twachtmann remembered in 1991. “I tried to solve problems, and environmentalists bashed the daylights out of me for it.”<sup>285</sup> Along with the Water Management District itself, however, Twachtmann would change his approach by the early 1970s. In a 2006 interview he remembered the impact critics of flood control exerted on his thinking. “When I started in 1951,” he recalled, “mostly Civil Engineering was a challenge: If there’s something out there to do, by Golly, we’re going to do it! Prove it can be done. We didn’t think about the natural systems. That was just not an important part of the consideration. And in my time, in those early 60s, in the Water Management District, a lot of my attitudes about that [were changed as] they were

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<sup>283</sup> Twachtmann, 1.

<sup>284</sup> Twachtmann, 4.

<sup>285</sup> Geoff Fox, “Dale Twachtmann, First Head of Swiftmud, Dies at 83,” *TBO.Com*, May 17, 2015, <http://www.tbo.com/pasco-county/dale-twachtmann-first-head-of-swiftmud-dies-at-82-20150517/>.

presented. I changed, I grew, and I adopted them. Because they were things that seemed to me to make sense, but things that I hadn't thought of before."<sup>286</sup>

### The SWFWMD in a time of political change

The founding of the Southwest Florida Water Management District coincided with enormous political changes at the state level. Since the late 19<sup>th</sup> century Florida's legislature had limited each county to just one senator and three representatives, even when the population of the three large counties in Southeast Florida started growing much faster than the more conservative, rural areas of the northern part of the state in the late 1940s.<sup>287</sup> Thus the Pork Chop Gang was able to direct state politics against the interests of the rapidly expanding suburban retirement and vacation areas in the south. This control was particularly obvious in the prolonged imposition of racial segregation throughout the state. In the late 1950's Florida's flood control projects were still bound to these state politics, and planners had to prioritize agricultural, ranching, and small-scale industrial interests along with those of suburban areas. For example, the C&SF District was repeatedly accused of prioritizing the needs of farmers around Lake Okeechobee over the water supply demands of Dade County.<sup>288</sup>

The lack of representative apportionment in the State Government began to change quickly after 1962 when the Supreme Court reaffirmed the principle of "one man, one vote" in the case of *Baker v. Carr*. Florida was forced reluctantly to reapportion the state legislature to accurately represent the population surge in the Miami, Tampa, and

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<sup>286</sup> Twachtmann, Interview with Dale Twachtmann on Water Management, 31.

<sup>287</sup> Swihart, *Florida's Water: A Fragile Resource in a Vulnerable State*.

<sup>288</sup> Godfrey and Catton, *River of Interests*.

Orlando areas. A new state constitution was approved in 1968. The Pork Chop Gang remained a force in Florida politics well into the 1970s, but greater representation from more diverse urban areas brought new concerns to Tallahassee. Some of these concerns centered on environmental quality – and especially clean water supplies – in the Tampa Bay Area. Thus the SWFWMD was quickly involved in this new arena of environmental politics, without the inertia shown in South Florida or Houston.

The first sign of political transformation was the surprise election of Governor Claude Kirk in 1966, a Republican businessman from Jacksonville and Palm Beach who had never before held political office. Kirk was the first Republican governor of Florida in 94 years.<sup>289</sup> He was outrageous, constantly self-promotional, and bombastic. He pushed back against federal efforts to desegregate Florida schools, and he created the state's first Departments of Environmental Protection and Law Enforcement. Most of all he was a great promoter of Florida for development and tourism. He was instrumental in bringing the 1968 Republican National Convention to Miami, and made a deal with Roy Disney that would lead to the development of Walt Disney World near Orlando. In his first year in office he hosted the Republican Governor's Conference in Palm Beach, and gave numerous television interviews. When asked about his constant showmanship, Kirk said, "I'm just sellin' orange juice. Sellin' orange juice, sellin' Kirk, sellin' Florida. People are paying attention."<sup>290</sup>

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<sup>289</sup> Matt Schudel, "Claude R. Kirk Jr., Colorful Ex-Governor of Florida, Dies at 85," *Washington Post*, September 28, 2011, [https://www.washingtonpost.com/local/obituaries/claude-r-kirk-jr-colorful-ex-governor-of-florida-dies-at-85/2011/09/28/gIQAWEMo5K\\_story.html](https://www.washingtonpost.com/local/obituaries/claude-r-kirk-jr-colorful-ex-governor-of-florida-dies-at-85/2011/09/28/gIQAWEMo5K_story.html).

<sup>290</sup> Mary Ellen Klas, "Former Gov. Claude Kirk Makes Final Visit to the Old Capitol," *Miami Herald: Naked Politics* (blog), September 30, 2011, <http://miamiherald.typepad.com/nakedpolitics/2011/09/former-gov-claude-kirk-makes-final-visit-to-the-old-capitol.html>.



*Figure 4.7 Derrill McAteer, c. 1969. Tampa Bay Times, 2016.*

Governor Kirk appointed Derrill McAteer, a Republican agricultural businessman, developer, and Tampa political ally, to the SWFWMD Governing Board. McAteer would replace banker Alfred McKethan as Chairman in 1969 and served in that role until 1980. McAteer would prove to be a dedicated public servant, a passionate conservationist, and, as the mission of the SWFWMD expanded beyond flood control, a champion of stronger regulations over groundwater usage. McAteer's son remembered that his father "had strong ties to agriculture, and people would come to him with third- or fourth-generation farms and say, 'Please don't condemn our farms,' or 'Please don't take away our pumping rights,'" he recalled. "That was one of the toughest things he had to do. He had to choose (the public interest) over their right to farm."<sup>291</sup>

McAteer may well have chosen the public interest over that of small farmers, but he also spent 40 years working for Lykes Brothers, Inc. – the largest landholder in

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<sup>291</sup> Dan DeWitt, "Epilogue: Derrill S. McAteer, a Pioneering Board Chairman of Swiftmud," *Tampa Bay Times*, December 28, 2015, <http://www.tampabay.com/news/environment/water/derrill-s-mcateer-pioneering-board-chairman-of-swiftmud/2259255>.

Central Florida, and one of the wealthiest families in Tampa.<sup>292</sup> McAteer ran one of their feedlots near Brooksville, the headquarters of the SWFWMD. The Lykes family ran large cattle ranching operations in Central Florida as well as many citrus farms. They were also in banking, shipping, and the local gas utility. In the 1960s they bought Sunkist brand orange juice and pioneered the production of frozen concentrate.<sup>293</sup> In 2004 McAteer claimed that he never had a conflict of interest between his job at Lykes Brothers and his Governing Board role at the Southwest Florida Water Management District. “All the years I was with Lykes Brothers, not once did they interfere with a decision that I made as a board member. Never.”<sup>294</sup>

### **The Four River Basins Project**

On the federal level, the primary response to the floods of 1960 was a new, comprehensive flood control project, modeled on the C&SF Project that had successfully

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<sup>292</sup> Diana J Kleiner, “Lykes Brothers,” The Handbook of Texas Online, 2010, <https://tshaonline.org/handbook/online/articles/etlzz>. The Lykes’ family of companies, run by the seven sons Howell T. Lykes and their descendants after the Civil War, were an interesting connection between Houston and Tampa during this period. In Tampa, two of the Lykes brothers were key to securing cattle shipping routes with Cuba after the Spanish-American War. They bought ranches in Cuba and developed meatpacking facilities there. Another brother, James McKay Lykes, brought the business to Galveston in 1903, shipping Texas cattle to Cuba and bringing back sugar to Gulf ports. The Lykes’ meatpacking and ranching business in Cuba collapsed in the 1940s, and their remaining land was confiscated in the Cuban Revolution, but the cargo shipping company had moved to Houston before the war and then had over 54 vessels on global routes. It became a public company in 1958. Meanwhile, the Lykes’ descendants in Tampa invested heavily in citrus, ranching, and logging operations, often exporting these products through the formerly family-run shipping business.

<sup>293</sup> Mike Vogel, “Family Feud,” *Florida Trend*, accessed December 14, 2016, <http://www.floridatrend.com/article/12859/family-feud>.

<sup>294</sup> Derrill McAteer, Interview with Derrill McAteer, interview by Julian Pleasants, Transcript, June 22, 2004, 20, Samuel Proctor Oral History Program, University of Florida Libraries, <http://ufdc.ufl.edu/UF00072680/00001>. Speaking for the interests of Pinellas County, Nelson Poynter’s St. Petersburg Times apparently wrote several articles – which I have yet to find – on McAteer’s potential conflicts of interest surrounding his Lykes Brothers career. It seems one way to interpret the winners and losers of water management in Tampa in the 1960s were large businesses over small farmers. I do not think that McAteer was purposefully serving the Lykes Brothers’ interests while Chairman of SWFWMD, but he did believe that the area’s future was not in small farming.

protected Miami. At first, the Four River Basins project made securing water supplies during droughts, such as the one in the early 1960s, a secondary, “collateral use” of the flood control system.<sup>295</sup> Prior to the floods of 1960, there had already been some basic planning for flood control in central and southwestern Florida. The general outlines of a major project to regulate the four main rivers of the watershed surrounding Tampa had been explored by the Corps of Engineers in 1958. These watersheds covered an area of 6,100 square miles that included the headwaters of the Hillsborough, Withlacoochee, and Peace rivers that all flowed into the Gulf of Mexico on the Southwest coast of Florida. The Four River Basins project covered part of the central ridge of Florida, dividing watersheds on both sides of the state, and the Oklawaha River that flowed from that same area into the St. John’s River and eventually into the Atlantic Ocean at Jacksonville. By December, 1960, as the region was still recovering from the second of the two major floods, the first proposal for a \$96 million dual-use project was already before Congress.

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<sup>295</sup> “Comprehensive Report on Four River Basins, Florida” (US Army Corps of Engineers, Jacksonville District, November 30, 1961), Box 9, Accession No. 077-96-0017, RG 77, National Archives at Atlanta. This concept of a system for flood control “and other purposes” was also part of the Comprehensive Report for the C&SF District in 1949. But the agricultural purposes of the C&SF district were stressed as almost equal to the flood control mission. In the case of the Four River Basins, water supply had to be added as an authorized, co-equal mission later, and that was after years of drought and public debate on how to address potential water shortages.

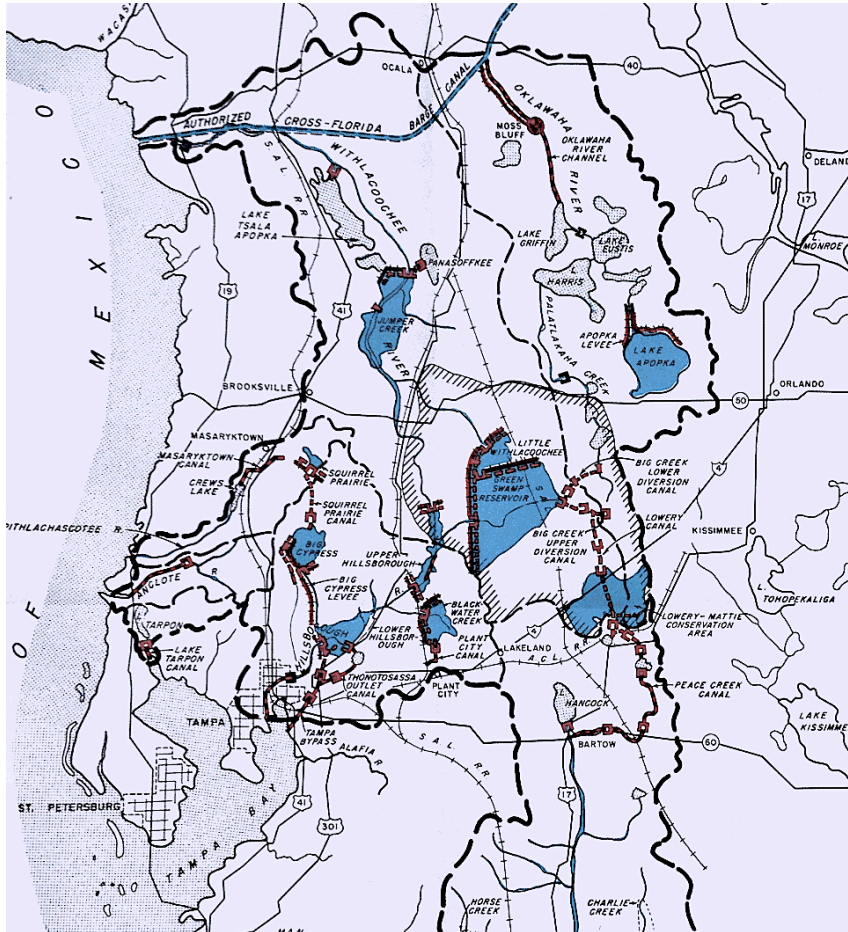


Figure 4.8 Map of Proposed Four River Basins Projects, 1961. Records of the Jacksonville District, US Army Corps of Engineers, National Archives at Atlanta.

As in Houston in the late 1930s, and again in Miami a decade later, the first step in the Four River Basins project was building local support. SWFWMD Director Dale Twachtmann recalled making hundreds of speeches, and going to “every Kiwanis club, every civic association in fifteen counties” to tell the story of why a federal project was necessary.<sup>296</sup>

As in Houston and Miami, a key early issue was determining the balance between local and federal financing. Generally, the formula was the same for the C&SF project.

<sup>296</sup> Twachtmann, Interview with Dale Twachtmann on Water Management.

Run out of the same District office in Jacksonville, the Corps of Engineers saw many similarities between the two regions, geographically.<sup>297</sup> The State of Florida's contribution, to be financed by the 16 counties comprising the new SWFWMD, was to be a 20 percent cash contribution of the total construction costs. The 1954 Rivers and Harbors Act had made this increase to a fifth of the total for local contributions to all new projects in the United States. Fifteen percent had been used originally in the C&SF project in 1949. SWFWMD and Corps of Engineers planners were concerned that a higher proportion of local contributions could be too burdensome for the relatively poor rural areas in the sixteen counties surrounding Tampa.

Local obligations rose further because few of the components of the Four River Basins system could be justified as simply flood control. Local authorities still needed to purchase most of the land to be used for ten reservoirs that would maintain water supplies during dry periods. Only some of those reservoirs were acting as water containment areas. As was the case in both Miami and Houston, local authorities additionally had to procure rights-of-way for levees, canals and control structures along the rivers. Of the estimated \$100 million total project costs, local contributions of cash, land, and maintenance were around \$42 million.<sup>298</sup> It became something more approaching a 50-50 split between Florida and the federal government.

At the local level, the politics and demographics of greater South Florida were starting to diverge from the rest of the Southeast (and Florida's own northern counties).

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<sup>297</sup> US Army Engineer District, Jacksonville, "Summary of Conference in the Jacksonville District Office on the Four River Basins Survey, August 10-11, 1961," September 1, 1961, Box 2, Accession No. 077-02-0045, RG 77, National Archives at Atlanta.

<sup>298</sup> Colonel Julian V. Sollohub, "Letter to Sam Mase, Tampa Tribune," November 21, 1962, Box 9, Accession No. 077-96-0017, RG 77, National Archives at Atlanta.



There were also much larger Corps of Engineers projects nearby, such as the Cross-Florida Barge Canal, that were already generating some significant local opposition. The Barge Canal was planned as a shortcut on the Intracoastal Waterway that would cut through the northern part of the state from Jacksonville, down the St. Johns river, and through a system of canals and reservoirs to Yankeetown on the Gulf of Mexico in the mostly-uninhabited “armpit” of the state.

Other large projects that attempted to extend the TVA-model of flood control, agricultural support, and power generation to different parts of the Southeast ran into increasingly organized efforts to slow or modify them. Opposition to federal projects was part of a broader pattern of resistance in the Southeast to large federal projects, such as dams on the Savannah River. In the 1960s, local environmental conservation efforts intersected with increased desires for state control as Southern politics generally became more wary of federal interference during the Civil Rights Era.<sup>299</sup>

As the Four River Basins project began to make its way through Congress in early 1961, the Corps of Engineers started surveying sites of reservoirs, levees, and canals. The studies the Corps undertook from 1960-1962 analyzed the hydrology of each river basin, how often floods occurred there, and in what season. The Corps also attempted to forecast how often floods would occur and their potential impact, given the scale of potential development in the region.<sup>300</sup> For this forecast, the Corps used demographic models to anticipate population increases and future land development. In contrast to the

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<sup>299</sup> Manganiello, *Southern Water, Southern Power*, 159.

<sup>300</sup> US Army Engineer District, Jacksonville, “Conference Summary on Four River Basins Survey”; Sam M. Gibbons, “Press Release from Sam M. Gibbons,” January 14, 1964, Sam Gibbons Papers, University of South Florida Libraries. In 1964, Representative Sam Gibbons claimed that avoided damages would be greater than \$8 million per year.

sprawling suburbs of South Florida, much of the development in the rural areas around Tampa was supposed to be for farming and ranching. In the early 1960s, suburban growth in the Tampa Bay Area was forecast to be more limited. This estimate changed dramatically a decade later, but the first forecast was essential to calculating the potential benefits from the “improved land use” that would most likely follow after flood control was a reality. At the time, the Corps of Engineers calculated that 60 percent of the project benefits would come from reduced flood damages, or about \$8 million per year, with the remaining 40 percent were connected to increased returns from land use.<sup>301</sup> Funding for the project in its entirety was authorized by Congress in October as part of the Flood Control Act 1962. The first large local contribution for the project was not required until 1965, when construction actually started. At that time, the State of Florida appropriated nearly \$5.5 million.

In a similar design to the original “emergency bypass” plan for the works in Houston, the Four River Basins system in the Tampa area was planned to safely hold back floodwaters in two major reservoirs and then slowly discharge the overflow waters through a canal that bypassed most downtown areas. The risk threshold was the “safe discharge of the standard project flood”, which was estimated as being 25 percent greater than the 100-year flood – or the “reasonable upper limit” of flooding on the Hillsborough River.<sup>302</sup> The Corps also modelled what the impact of the 1960 floods would have been if the Four River Basins project had been functioning at the time.

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<sup>301</sup> US Army Engineer District, Jacksonville, “Conference Summary on Four River Basins Survey.”

<sup>302</sup> Southwest Florida Water Management District, “A Plan for the Use and Management of the Tampa Bypass/Harney Canal,” 1990, <http://www15.swfwmd.state.fl.us/LibraryImages/00595.pdf>.

Plans for the Four River Basins project were even more extensive for the rural, interior region beyond the more urbanized coast. Realizing that water conservation for farmers was equally as important as flood control, the Corps of Engineers planned ten reservoirs in total. They even included a plan to connect the reservoir system all the way to giant Lake Apopka at the head of the Oklawaha River near Orlando. There were other, cheaper solutions for flood control – such as a plan limited to just two canals and widening bottlenecks on the rivers - but these approaches would not have provided “safe storage of water”.<sup>303</sup>

#### Development, Environmental Concerns, and Unfinished Designs

Suburban development in the counties around Tampa did not take off with the same immediacy as Miami and Houston in the 1950s and 1960s. While the Eastern “Gold Coast” was becoming a contiguous urban area, much of the land in northern Hillsborough, Pasco and Hernando counties remained rural into the 1980s. There were some scattered projects planned during the late 1960’s for the large, rural areas of the Four River Basins, but few were actually built until more than a decade later.

In 1967, for example, the Mackle brothers’ Deltona Corporation planned what would have been a small city of 50,000 residents in Hernando County near Brooksville (headquarters of the SWFWMD), 45 miles north of Tampa.<sup>304</sup> A few years earlier the Mackle brothers had successfully developed the affordable retirement community of Marco Island from mangrove swamps near Naples and the town of Deltona on more solid

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<sup>303</sup> Sollohub, “Letter to Sam Mase.”

<sup>304</sup> “Deltona Corporation Plans 34-Sq. Mile Townsite,” *Florida Trend*, January 1967, Box 2, Accession No. 077-02-0045, RG 77, National Archives at Atlanta.

ground north of Orlando.<sup>305</sup> Thousands of Tampa area residents drove to Hernando County and toured the dusty layout of unfinished roads and golf courses on its opening day. The 1960 flood that had nearly wiped out the chickens in nearby Masaryktown was mostly forgotten after years of drought, but the new developers still celebrated with an annual chicken-plucking contest.<sup>306</sup>

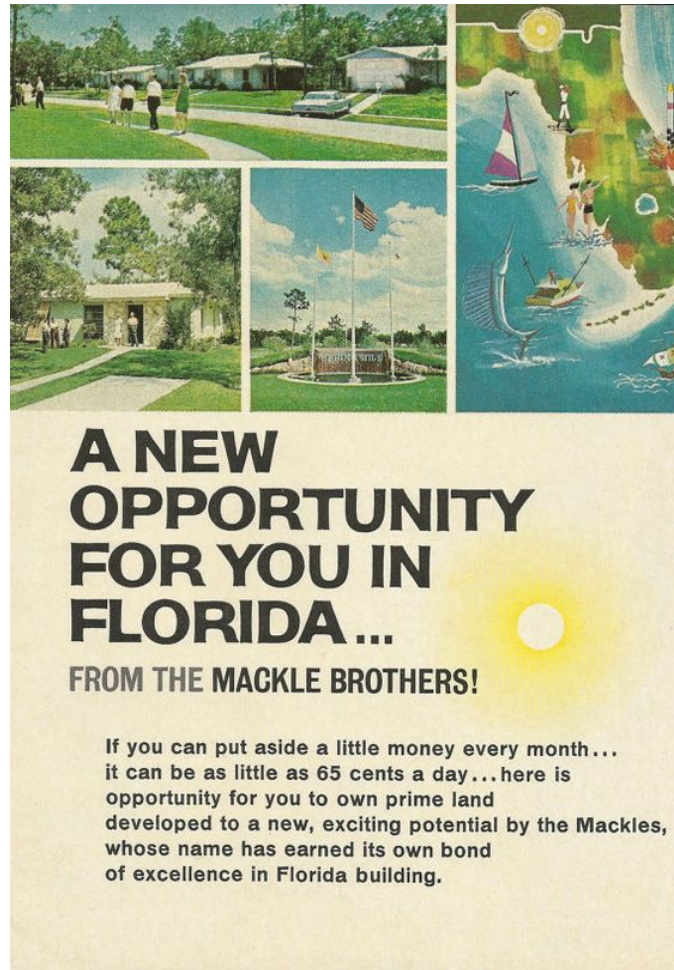


Figure 4.9 Cover of brochure promoting Spring Hill, 1968.

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<sup>305</sup> Jack E. Davis, *The Gulf: The Making of An American Sea* (Liveright, 2017), 379.

<sup>306</sup> Frank E. Mackle, "Along The Way," The Mackle Company, accessed November 11, 2016, <http://www.themacklecompany.com/femjrstorypublic/18-deltona-alongtheway.htm>.

With aggressive sales in New York City, nearly 28,000 modest lots, in what became known as “Spring Hill”, were sold by 1970.<sup>307</sup> But most those lots were sold on installment plans and few homes were built until the early 1980s. Although rural land remained cheap, a slowing national economy, combined with growing inflation and higher interest rates on mortgages, did not support these large-scale projects as they moved out of the planning phases in the early 1970s. Because projects such as Spring Hill were already faltering, the rise of environmental regulation probably had little impact on development in the Four River Basins area. But new environmental regulations did irreparably damage the Deltona Corporation when the Corps of Engineers refused to issue dredging permits for the continued filling of mangrove wetlands around Marco Island, the Mackle’s most valuable development.<sup>308</sup>

The Four River Basins Project itself did not long maintain its momentum. With early pushback against land purchases by rural communities, the strengthening of environmental concerns in the late 1960s, and more limited federal budgets, only two of the ten reservoirs were ever completed. As early as 1965, the first representative from Tampa’s newly-created tenth Congressional District, Sam Gibbons, had to bring images

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<sup>307</sup> Rocco Maglio, “History of Spring Hill,” *Hernando Sun*, 2016, [https://hernandosun.com/spring\\_hill\\_history](https://hernandosun.com/spring_hill_history).

<sup>308</sup> James Russell, “Mackles in Toughest Fight,” *Miami Herald*, April 25, 1976, <http://www.themacklecompany.com/femjrstorypublic/images2/04-25-76macklesintoughestfight1494.jpg>. With an expanded authority created by the Clean Water Act Amendments of 1972 the Corps of Engineers greatly widened the scope of its permitting process beyond narrow considerations of the impact of a private development on navigation. Now the Corps began to base permitting decisions on water quality, wildlife, and ecosystem health issues that were central to the national environmental movement. The Mackles plans for Marco Island involved the destruction of critical mangrove wetlands; they had essentially sold property that was still underwater and had to be dredged and filled. This transformation of wetland into dryland was not a problem in the 1960s, but the Corps growing responsibility for reducing environmental impacts in the 1970s dramatically changed the calculation for these permits.

of newly-flooded homes along the Hillsborough River to the House Appropriations Committee in order to secure an extra \$600,000 to get the Four River Basins project out of the planning phases.<sup>309</sup> Gibbons, who had run Kennedy's 1960 campaign in Florida, had counted on promises from the President to fully fund the Four River Basins flood control projects, but as the costs of US involvement in the Vietnam War increased, President Johnson asked Congress to restrict spending on new civil works projects.

The key reservoir that would have inundated the Green Swamp and the headwaters of the four rivers was never built. Instead the area became a wilderness preserve that also acted to store and filter much of the region's water. Water quality, and especially cleaning up pollution in Lake Apopka and Tampa Bay, became the focus of grassroots environmental groups in the 1970s. Ironically, the Squirrel Prairie works that had been planned to protect and provide water for the farming town of Masaryktown, whose drowned chickens had been so prominent in the call for flood control, were never built. Masaryktown did get a much smaller 5.5 mile canal that ended up preventing significant flooding in 1998 and again in 2004 after hurricane Frances crossed the state. The canal cost a little more than \$760,000 when it was completed. Out of a dozen planned structures in the Four River Basins, the Masaryktown canal was one of only four that were ever completed.<sup>310</sup>

The following, chronologically-overlapping sections of this chapter detail the compromises made on several of the Four River Basins Project's key components.

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<sup>309</sup> Charles Stafford, "Funds Added to U.S. Bill for State Water Project," *Tampa Tribune*, August 20, 1965, Sam Gibbons Papers, University of South Florida Libraries.

<sup>310</sup> Dan DeWitt, "Yesterday's Lessons Redirect Floodwater," *St. Petersburg Times*, September 26, 2004, [http://www.sptimes.com/2004/09/26/Hernando/Yesterday\\_s\\_lessons\\_r.shtml](http://www.sptimes.com/2004/09/26/Hernando/Yesterday_s_lessons_r.shtml).

### The Tampa Bypass Canal (1966-1981)

The Hillsborough River is Tampa's river. It runs 60 miles from the Green Swamp on the central Florida plateau through Tampa's northern suburbs and then through some of the city's oldest neighborhoods on its way to Tampa Bay. The city's earliest water supply came from the Hillsborough River, and it was flooding on the Hillsborough River that caused the most extensive damage to the city after the storms of 1960. That spring, before Hurricane Donna turned flood control into a regional project, Hillsborough County Commissioners and Congressional representatives from the Tampa Bay area investigated the possibility of just cleaning out and enlarging the Hillsborough River to handle floodwaters from the next storm. Since the Hillsborough River was connected to channels leading into the Port of Tampa, this more limited project could be argued to be already within the scope and budget of the Corps of Engineers' mission to maintain navigation on the nation's waterways. But Colonel Paul Troxler, the District Engineer in Jacksonville, had the area surveyed and concluded that the "clearing and snagging" project on the river would be too expensive for the District's budget already set aside for similar maintenance.<sup>311</sup> Instead, he encouraged local representatives to support the vastly larger, comprehensive flood control project proposed for the Four River Basins. When Hurricane Donna roared through a few months later, the simpler, local solutions no longer seemed appropriate to the repeated risk.

Even after the Four River Basins project was authorized, the SWFWMD again looked into improving the Hillsborough River itself to handle floods. Once again the high

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<sup>311</sup> Colonel Paul D. Troxler, "Letter to Ellsworth Simmons, Chairman, Board of County Commissioners, Hillsborough County," May 16, 1960, Box 3, Accession No. 077-02-0045, RG 77, National Archives at Atlanta.

costs of buying rights-of-way, redirecting sewers and powerlines, and clearing out the rocky, twisting channel did not justify the benefits to Tampa and its suburbs – if there were a cheaper means of flood control for the city.<sup>312</sup> The Corps of Engineers also estimated these costs, and verified that the Hillsborough River could be cleared of obstructions in order to successfully carry the volume of 75 percent of the Standard Project Flood, but during that kind of event the flow of water through residential neighborhoods would be rapid and dangerous.

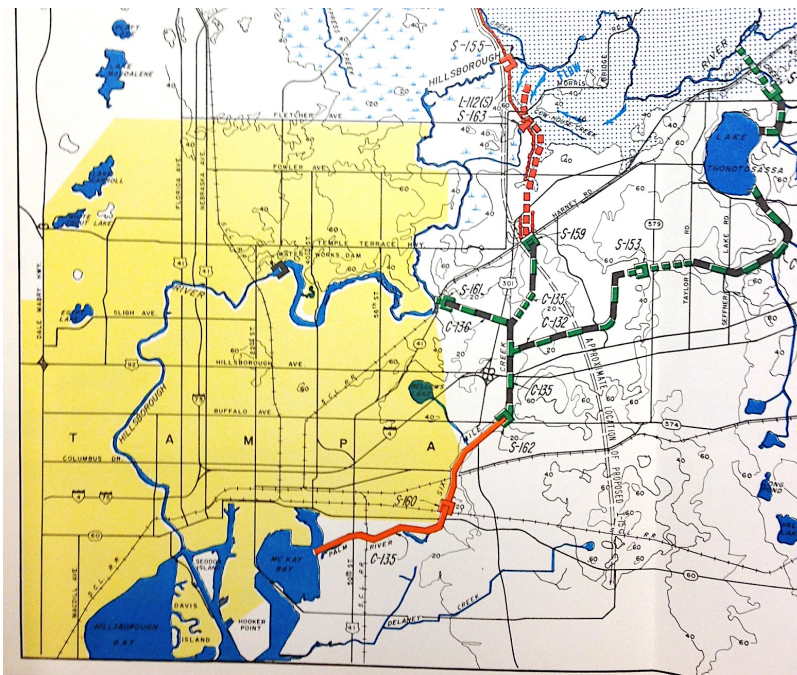


Figure 4.10 Plan for the Tampa Bypass Canal (Completed sections marked in red and planned sections in green), 1975. Records of the Jacksonville District, US Army Corps of Engineers, National Archives at Atlanta.

Instead a less-expensive, and more effective, 14-mile canal was planned to divert water from the Hillsborough River around the city of Tampa and into a corner of Tampa

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<sup>312</sup> Dale Twachtman, "Letter to J. Harold Grimes, Chief, Design Branch, Engineering Division, US Army Corps of Engineers Jacksonville," September 17, 1965, Box 3, Accession No. 077-02-0045, RG 77, National Archives at Atlanta.



Bay during floods. The Tampa Bypass Canal, started in 1966 and not fully completed until 1981 because of years of budget constraints, became the primary protection for the city of Tampa and its closest suburbs. During major flood events, gates on the canal fully open to allow the maximum amount of water to exit the river. It was designed to provide “standard flood protection”, which, along with the Four River Basins project as a whole, was based on the 100-year flood which was greater than what the city had seen in 1960.<sup>313</sup>

As work on the Tampa Bypass Canal continued, some of the water storage components of the Four River Basins project were clearly in trouble due to funding shortages, the high cost of land acquisition, and local resistance. It became clear to the SWFWMD that the Bypass Canal itself could be used as an alternative area to store water. Working with Jerry Parker, a hydrogeologist, who had formerly been with the US Geological Survey, SWFWMD made the case to the Corps of Engineers that the Tampa Bypass Canal should be able to store water as well as prevent floods in the city. In the late 1960’s, a small dam and control structure on the Hillsborough River in the suburb of Temple Terrace were added to the canal’s designs. It was thus transformed into an elongated reservoir during rainy years. Only in the most severe flooding events would it shunt the river’s overflow into Tampa Bay.

Starting again in the early 1970’s, SWFWMD executives and Tampa Congressman Sam Gibbons repeatedly appealed to Congress asking for appropriations to continue work on the Tampa Bypass Canal.<sup>314</sup> SWFWMD Director Don Feaster “said he

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<sup>313</sup> Southwest Florida Water Management District, “Plan for the Use and Management of the TBC.”

<sup>314</sup> Sam M. Gibbons, “Statement of Congressman Sam M. Gibbons Before Public Works Subcommittee Appropriations Committee,” May 15, 1973, Sam Gibbons Papers, University of South

was beginning to ‘sound like a parrot’ because of repeated delays in completing the bypass canal.”<sup>315</sup> At an Appropriations Committee hearing Congressman Gibbons noted that after more than \$22 million had been spent on the canal, with an expected \$8 million more in 1973, President Nixon’s budget included only \$1.5 million, which meant almost no progress could be made towards completing the remaining nine miles of excavation. The following year’s budget was down to only \$400,000 for the canal. Gibbons argued that this one piece of the Four River Basins Project was essential for the safety of the city of Tampa and had no alternative.

It would take another seven years to complete, with most funding restored under President Carter. The SWFWMD and Corps of Engineers have insisted ever since that there was no cost-effective alternative to this system.<sup>316</sup> The city had been spared major storms until only a few years after the Bypass Canal was completed. On Labor Day weekend, 1985, the system was put to the test when Hurricane Elena stalled off the Florida coast in the Gulf of Mexico, producing heavy rainfall for days, although never making landfall in the state. The Tampa Bypass Canal was first put into operation and proved successful at preventing flooding in the city.

The outcome of the designs for the flood control system in Tampa were essentially the opposite of what had happened in Houston. Designs in both cities had called for dams, reservoirs, and bypass canals. In Houston, the bypass canal was never

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Florida Libraries. At the same time Congressman Gibbons was also requesting even larger appropriations to finish the deepening of the channel into the Port of Tampa, a project he recognized was even more essential to the region’s export economy.

<sup>315</sup> Morris Kennedy, “SWFWMD Officials Blue about Budget,” *Tampa Times*, March 8, 1974, Sam Gibbons Papers, University of South Florida Libraries.

<sup>316</sup> Southwest Florida Water Management District, “Plan for the Use and Management of the TBC.”

built, and the dams provided primary flood control. In Tampa, the dams were never built and the bypass canal was the key solution. In the case of Tampa, the bypass canal was less than half as long as what had been planned for Houston – 14 miles instead of 35. In contrast to both Houston and Tampa, the massive projects in Miami used multiple levees, dikes, pumping stations, and hundreds of miles of canals, to transform a seasonally watery landscape into permanently dry land.

#### The Green Swamp Project: The power of local resistance (1962-1974)

In the early years of the Four River Basins project, resistance to dams, reservoirs, and flooded “water conservation areas” had been growing in other parts of the region. This opposition was especially pronounced in the small towns and ranching areas of Central Florida, high up on the backbone of the state, that had not seen such extensive flooding from Hurricane Donna. The controversy around the Green Swamp eventually centered on the issue of preserving land entirely for its ecological services. Protecting the Green Swamp became the SWFWMD’s strategy to ensure fresh water supplies by recharging the underlying Floridian Aquifer at its highest point.

As early as March, 1962, before the Four River Basins Project was authorized by Congress that October, the Polk County Property Owners League and the city of Winter Haven had vigorously opposed plans to transform the Green Swamp into a reservoir that would have flooded over the many spring-fed lakes and wetlands in the area.<sup>317</sup> Concerns about development, rising property values, and land-use were most important to the Property Owners League when they started their appeal. Arthur Bissett, the Managing

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<sup>317</sup> Sollohub, “Letter to Sam Mase.”

Director of the Property Owners League, wrote that the Green Swamp was Polk County's "last frontier" and "must be left available for this expansion of our agriculture in order that the tax and business economy of the County is not depressed."<sup>318</sup>

The Property Owners League contacted Senator Spessard Holland, long a friend of rural interests in South Florida, to halt construction of the reservoir pending additional studies by the Corps of Engineers. Fifteen years earlier Senator Holland had pushed through the massive C&SF flood control projects in the Everglades by aligning the interests of growing cities such as Miami with farmers around Lake Okeechobee. Now he would play a far more ambivalent role in giving voice to rural interests in the Tampa area that did not clearly see the benefits of development.

The Property Owners League hired a consulting engineer, Raymond Stuck, to make an official critique of the entire Four River Basins project. First Stuck, who had retired from the Corps of Engineers after a long career, attacked the essential cost-benefit ratio that justified the project. He claimed it would be at least \$200 million – twice as expensive as planned – because of increased land values and the challenges of building heavy, leak-proof structures in the sandy soils beneath the swamp. If there was too much seepage around the levees, then they would not work to contain floods or store water in dry years. Another former Corps of Engineers officer, retired Colonel Herbert Gee, who had been consulting for the SWFWMD, responded that the construction cost estimates

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<sup>318</sup> Arthur M Bissett, "Letter to Colonel J.V. Sollohub, District Engineer," November 20, 1961, Box 9, Accession No. 077-96-0017, RG 77, National Archives at Atlanta.

for the Four River Basins had been based on the Corps' extensive experience in similar conditions with the C&SF Project over the past decade.<sup>319</sup>

Stuck also argued that the Green Swamp was not the primary source of flooding in Tampa, nor would a reservoir there fill quickly enough to act as a worthwhile water conservation area, and certainly not quickly enough to recharge the aquifer below. As Stuck testified to the Senate Subcommittee on Rivers and Harbors in September, 1962, "the great damage resulting in Tampa and over that watershed is from the rain that fell directly on them, not rain that came from the Green Swamp area, because it contributes too little: but if you make a study of storms that happened in there, they centered right over Tampa and there was not enough outlet for this water to get out into the bay, and it simply drowned them out."<sup>320</sup> Responding for the SWFWMD, Colonel Gee pointed out that the Withlacoochee River, with origins in the Green Swamp, also contributed to the severity of the 1960 floods in Tampa. Only a major reservoir in the headwaters could prevent flooding on a regional scale and, more importantly, maintain the level of the aquifer for the region's growth.

In 1962 the SWFWMD framed Stuck's report and the Polk County Property Owner League's campaign as an "attempt of desperation to cast doubt on a worthy project in high places with the hope of arousing enough doubts to result in its not being authorized in this session of Congress." A year later the Corps of Engineers dismissed

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<sup>319</sup> Herbert C. Gee, "Statement of H.C. Gee to Southwest Florida Water Management District on 'Critique of Four Rivers Project,'" April 9, 1962, Box 9, Accession No. 077-96-0017, RG 77, National Archives at Atlanta. After the war Herbert Gee had in fact been assigned to set policies for flood control projects nationally for the Chief of Engineers in Washington, and he had been instrumental in designing the C&SF project in response to the massive floods of 1947 in Miami.

<sup>320</sup> Raymond Stuck, "Hearing before the Subcommittee on Flood Control, Rivers and Harbors," § Senate Committee on Public Works (1962), Hathitrust.org.

both the uproar of the Polk County property owners, and the quieter concerns of W.W. Cummer, a former cypress lumber king and big landholder in Pasco County, as really an attempt to keep their property taxes low indefinitely. Reservoirs would inundate less valuable swampland, and thus make logging and ranching operations on the remaining land less profitable. “While such a purpose is understandable,” the Jacksonville District Engineer wrote to the Division Engineer in Atlanta, “it puts the organizations in the position of opposing all significant progress in the region and preventing normal and potential development.” As with both Houston and Miami, at first it seemed that local resistance would only delay work on the overall Four River Basins project but not prevent its completion. Construction of the Green Swamp Reservoir was postponed until the Corps of Engineers could complete a restudy and new cost-benefit analysis, but the rest of the system was authorized by Congress.

Within a few years, however, it was clear that the region around Tampa was very different from Houston and Miami. Local interests were more diverse and conflicted between urban and rural areas, and between counties, without a singular vision that had united them in Texas’ Harris County and on the opposite coast of Florida. The Green Swamp Reservoir was the first, but not the last, of the Four River Basins components that would never be completed. Raymond’s Stuck’s critique had been essentially right in its conclusions that construction costs would be much higher than expected because land would become so much more valuable in the region, and the Property Owners League demonstrated just how effective local resistance could be.<sup>321</sup>

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<sup>321</sup> Twachtman, Interview with Dale Twachtman on Water Management, 15.

Even though there was to be no reservoir in the Green Swamp, the ranchers and citrus farmers of Polk County ultimately would not get the opportunity to develop their “last frontier”. Raymond Stuck had been wrong about how crucial the Green Swamp was to the Floridian Aquifer below it. SWFWMD executives were convinced that it had to be protected, one way or another, as the primary source of the region’s fresh water. As former SWFWMD executive director Dale Twachtmann remembered, “The Corps knew that that was a key recharge area. So the Corps project had big reservoirs there to hold water. But that was again, you hold water for long periods of time you’re going to kill all the trees and all this. So we decided we’d just buy all the land. Then it could stay in its natural state. If government owned it, you could control it as best possible to let water stay on it and let it do its ace recharge work.”

Former chairman Derrill McAteer recalled personally purchasing the first part of the Green Swamp for the Water Management District in the early 1970s. He bought the last of the Cummer Land Company’s former cypress logging territory from W.W. Cummer himself over a sandwich and a handshake. “Mr. Cummer and I sat down under a tree, eating that barbeque, and I bought the last of it for \$103,000. That’s the heart of the district; it’s the heart of the deal.”<sup>322</sup> The rest of the Green Swamp would be purchased in the next few years.

The reapportionment of the state legislature in the late 1960s, population shifts to South Florida, and a strengthening environmental movement all laid the groundwork for an exceptionally progressive state government in the mid-1970s. Words such as “carrying

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<sup>322</sup> McAteer, Interview with Derrill McAteer, 13.

capacity” and “limits to growth” were starting to be used by state planners.<sup>323</sup> The crowning achievement of environmental advocates was the Florida Water Resources Act of 1972, sponsored by Governor Reubin Askew who had come into office the previous year. Water managers such as Derrill McAteer campaigned along with Governor Askew across the state to gain support for this transformational legislation. It divided the entire state into water management districts, and gave them permitting power for water use. That same year, the Florida Environmental Land and Water Act created a fund to purchase environmentally sensitive land.

By 1974, the Florida Department of Natural Resources had allocated \$23 million to the SWFWMD to purchase the rest of the Green Swamp and much of its surrounding watershed. Those areas were designated a state Area of Critical Concern which limited how much development could happen on those lands. Local opposition was no longer strong enough to overcome a governor and state legislature that built political power from cities such as Miami, Orlando and St. Petersburg rather than rural counties. The headwaters of the four river basins was now mostly a nature preserve, and a non-structural, natural water storage area and filtration system for the Floridian aquifer. For the growing cities and suburbs of the Tampa Bay Area, this was clearly a victory as a key critical water source was now protected.

#### The fate of Hillsborough River dams and the rise of “natural” flood control (1968-1975)

While the Tampa Bypass Canal was one structural component of the Four River Basins Project that was actually completed, other works planned for higher up the

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<sup>323</sup> “Southwest Florida Water Area Model for Future,” *The Tampa Tribune-Times*, July 21, 1974, Sam Gibbons Papers, University of South Florida Libraries.



Hillsborough River shared a similar fate to the unfinished Green Swamp Reservoir. In 1967 a dam and permanent reservoir had also been slated to be constructed closer to river's headwaters in the Green Swamp. It had been seven years since significant flooding had affected the Tampa Bay Area and Water Management District leaders were questioning how robust the system actually needed to be. Part of this reconsideration was the increased costs of acquiring land for reservoirs and rights-of-way for canals and channels. After several dry years in the early 1960s, reservoirs seemed to be more important for ensuring water supplies rather than flood control. These issues concerning costs and the risk of future floods were key to planning the Upper Hillsborough Reservoir.<sup>324</sup>

At a progress meeting between Corps of Engineers planners and SWFWMD executives in July, 1968, Executive Director Dale Twachtman brought up the observation that recent visits to the Upper Hillsborough Reservoir site after summer storms had shown there was only two feet of water where they were planning for 80 feet to be in the event of a 100-year flood. "It does not appear possible that 100-year plus elevations would be in the area at this time", Twachtman observed.<sup>325</sup> He asked if a lower level of protection could be evaluated for some reservoirs in the system, assuming projected development in the region, so the SWFWMD would not have to acquire as much land. Angelo Tabita, Assistant Chief for Project Planning at the Jacksonville District, claimed that surveys in the area had been poorly executed and new analysis would allow for better planning. The Corps refused to back away from the size of the

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<sup>324</sup> Angelo Tabita, "Four River Basins Project: Memorandum for the Record, July 23, 1968," 1968.

<sup>325</sup> Tabita.

reservoir, and thus the degree of protection that should be provided by the flood control system.

By the 1970s, environmental concerns and budget constraints were transforming areas of civil engineering practice. Structural flood control – which depended on man-made works such as levees, dams, and canals – was less in favor than solutions that utilized features of the natural floodplain to reduce flooding from the start. This change in paradigm, largely based on the work of Geographer Gilbert White, meant strictly limiting development in key natural areas that could help dissipate floodwaters.<sup>326</sup> For the Tampa Bay Area it meant creating nature parks for flood control.

State institutions responsible for flood control, such as the SWFWMD, had tried unsuccessfully in the 1960s to get developers to stop building in floodplains, but they did not have the legal authority to deny permits. That type of regulation remained on the county level. Former SWFWMD chair Derrill McAteer remembered trying to educate “desperate” local county commissioners about putting zoning in floodplains that would limit development. “At that point they had more authority than we [Swiftmud] did,” he recalled, “I said, let’s have some flood plains zoning. [They said] Oh, no, we can’t do that. I said, well, then, don’t complain to me. If you’re not willing to have flood plains zoning in your county.”<sup>327</sup>

The impact of the Water Resources Act of 1972 on the strategies used by the SWFWMD cannot be overstated. Before 1972, the Southwest Florida Water Management

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<sup>326</sup> Willingham, “The U.S. Moves towards More Integrative Approaches to Water Resources Management, 1970-2010,” 235; Martin Reuss, “Shaping Environmental Awareness: The United States Army Corps of Engineers Environmental Advisory Board, 1970-1980” (Historical Division of the Office of the Chief of Engineers, January 1983), 33.

<sup>327</sup> McAteer, Interview with Derrill McAteer, 8.

District had “water management” power only in name. Its primary purpose had been as the local coordinating agency on the Four River Basins flood control projects. Now it would have legal authority to regulate groundwater usage and funds to acquire land that was not going to become part of a federal canal or reservoir. Derrill McAteer noted that these new powers changed the District’s strategy. “Flood control is a phase of water management, of course,” he recalled. “But we began to look and see, what do we have, like the Upper Hillsborough Reservoir, other places that we had already planned to acquire for flood control purposes, now could become municipal water supply purposes, which I melded them together. That’s what really happened at that point.”<sup>328</sup>

Further down the Hillsborough River, closer to the outskirts of Tampa, SWFWMD demonstrated its new intention to prioritize water quality and environmental protection along with flood control in the 1970s. Starting in 1973, SWFWMD began to purchase an area that amounted to more than fifteen thousand acres of pine forest and wetlands just northeast of Tampa.<sup>329</sup> This purchase was an example of a primarily nonstructural approach to flood control in action, as the Four River Basins Project was starved for cash from the Federal Government.

The land was officially called the Lower Hillsborough Flood Detention Area, but SWFWMD publically managed the lands it acquired as a “wilderness park”. Recreational uses of the park were, in fact, a primary fundraising tool. Much of the land was purchased using recreation bonds, in partnership with Hillsborough County. The Lower

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<sup>328</sup> McAteer, 22.

<sup>329</sup> Southwest Florida Water Management District, “A Plan for the Use and Management of the Lower Hillsborough Flood Detention Area,” August 30, 2005, [https://www.swfwmd.state.fl.us/recreation/pdf/2005\\_Lower\\_Hillsborough\\_FDA\\_LU-Mgmt\\_Plan.pdf](https://www.swfwmd.state.fl.us/recreation/pdf/2005_Lower_Hillsborough_FDA_LU-Mgmt_Plan.pdf).

Hillsborough Flood Detention Area was a critical buffer zone for works connected with the Four River Basins project.<sup>330</sup> The area included a small levee and control structure to block floods on the Hillsborough River from entering the Tampa suburb of Temple Terrace and eventually the city itself. If enough water accumulated in the detention area, it overflowed into the Tampa Bypass Canal which then shunted the excess to Tampa Bay. By maintaining much of the Flood Detention Area as parklands free from intensive development, the SWFWMD helped reduce runoff and preserve some 13 miles of the Hillsborough River in its original floodplain. Critically, purchase of the Flood Detention Area lands also protected the Morris Bridge Wellfield that was an important source of municipal water supplies.

#### **Chapter summary**

Tampa's flood control projects were inspired by repeated regional floods in the summer of 1960. At the time, the success of the C&SF Projects in Miami and the completion of large civil works around the country made it seem like a regional flood control system on the Gulf Coast of Florida was inevitable. But Tampa's local politics were very different from Houston and Miami's. The region was still largely rural, and developing cities on both sides of Tampa Bay competed for resources with farmers and ranchers. From the beginning the SWFWMD was put in an awkward role of trying to champion large federal flood control projects while also trying to manage fresh water supplies with almost no regulatory power.

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<sup>330</sup> Southwest Florida Water Managment District, "Information Sheet for General Welling," March 6, 1964, Box 2, Accession No. 077-02-0045, RG 77, National Archives at Atlanta.

But the timing of flood control in Southwest Florida, along with the rise of environmental activism, was particularly critical. Unlike the rapid pace of the development of the water management system around Miami in the 1950s, the design and planning phases of the Four River Basins Project were carried out slowly during a decade when concerns about the quality of natural resources and impacts to wildlife were gaining widespread popular support. Meanwhile, Congressional appropriations aimed to start construction ran into tight, wartime budgets and economic downturns in the late 1960s and early 1970s. The SWFWMD was thus forced to use a variety of seemingly forward-thinking, non-structural approaches to protect critical water sources and restrict development in flood prone areas. In retrospect, Water Management District leaders recalled their environmental enlightenment, along with the frustrations that allowed only minimal progress on the Four River Basins Project.

## CHAPTER 5

### ENVIRONMENTAL ACTIVISM AND FLOOD CONTROL IN HOUSTON, MIAMI, AND TAMPA (1966-1985)

Houston, Miami and Tampa are all cases of explosive, postwar sunbelt population growth. The exact timing of that development is different in each case, but all three cities entered the 1970s as centers of sprawling metropolitan regions. This was a period when questions about resources, population and the “limits to growth” were part of a national intellectual conversation.<sup>331</sup> Locally, however, concerns about suburban development were more focused on quality of life and essential services, such as reliable fresh water supplies, smog, and the preservation of areas of natural beauty that were quickly disappearing.<sup>332</sup>

One of the commonalities between the narratives of flood control in Miami, Houston, and Tampa is that these kinds of concerns became prominent in each city in the late 1960s, and local grassroots organizations were then able to mobilize around these issues to build significant political pressure for reassessments of flood control projects in the 1970s. Combined with budget shortfalls, these reassessments sometimes led to the redesign, and more often than not, the cancellation, of components of the protective

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<sup>331</sup> Thomas Robertson, *The Malthusian Moment: Global Population Growth and the Birth of American Environmentalism*, Studies in Modern Science, Technology, and the Environment (New Brunswick: Rutgers University Press, 2012).

<sup>332</sup> Rome, *The Bulldozer in the Countryside*.

infrastructure. The following chapter compares the impacts of environmental awareness and activism on the plans for flood control in each city.

### **Houston and the campaign to save the bayous, 1966-1971**

As in many parts of the country, the environmental movement in Houston combined quality of life issues, such as pollution control, with concerns for suburban, natural aesthetics.<sup>333</sup> Early attempts to “beautify” and transform Houston’s bayous into park-like areas started just as the first round of federal flood control projects were nearing completion in the late 1940s. Now that there was less urgency to control damaging floods on Buffalo Bayou downtown, it was possible to consider the condition of the waterway itself. In the late 1940’s Buffalo Bayou was full of debris and sewage. Its banks were eroding, steep and inaccessible.

Starting in 1948, the city of Houston and Harris County shared the \$400,000 cost of shoring up the banks, removing debris and fallen trees, and deepening the streambed over three miles of the bayou near downtown.<sup>334</sup> Memorial Drive and Buffalo Parkway ran along the either side of the bayou. These efforts were characterized as “beautification”, and they did make the bayou more visible and accessible from the road, but they were, in fact, a form of channelization used commonly to improve urban drainage.

Channelization projects continued on Houston’s bayous during the 1950s and 60s. Despite the challenge of convincing voters to authorize funding for flood control bonds to carry out more extensive work, the Harris County Flood Control District continued to

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<sup>333</sup> Ibid.

<sup>334</sup> “Buffalo Bayou Beautification to Be Started,” 1948, Squatty Lyons Papers, Harris County Archives.

remove obstructions, clear trees, and to cover the banks of some bayous with sod to hold them in place. When the second phase of the Buffalo Bayou and Tributaries Project was finally approved, federal funds appropriated, and local bonds issued in 1957, more extensive channel rectification – straightening, deepening, and concrete lining – commenced in some areas. While these improvements were supposed to allow the bayous to carry water faster through the city, and thus prevent the backups that caused suburban flooding, the higher-speed channels also contributed to more sudden flash floods in some neighborhoods.

In 1966, the Buffalo Bayou Preservation Association was formed by upset residents of the upper middle-class Memorial neighborhood in order to stop Corps of Engineers channel-clearing efforts on a nearby section of Buffalo Bayou.<sup>335</sup> One of those residents, Terry Hershey, arguably became Houston’s greatest environmentalist. Hershey had settled in the Memorial area with her husband, Jacob Hershey, then CEO of American Commercial Barge Lines, a few years earlier. She had a key role in organizing local efforts to preserve the natural beauty of neighborhood waterways and to stop the continued channelization of Houston’s bayous.<sup>336</sup>

A young Congressman George H.W. Bush called for hearings where local activists could testify to damages in their neighborhoods. In 1967, the Corps of Engineers agreed to yet another restudy of the Buffalo Bayou project, this time giving some consideration to non-structural alternatives to rectification, and after a few attempts to

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<sup>335</sup> Tomkins-Walsh, “To Combine Many and Varied Forces.”

<sup>336</sup> Kim McGuire, “Environmentalist Who Saved Buffalo Bayou Dies at 94,” *Houston Chronicle*, January 19, 2017, <https://www.houstonchronicle.com/news/houston-texas/houston/article/Environmentalist-who-saved-Buffalo-Bayou-dies-at-10870433.php>.



maintain their former approach, ultimately transformed their designs for the bayou from a straightened, concrete ditch to a wetland recreation area and chain of city parks.

In the 1950s and early 1960s, civic and business leaders across the sunbelt had been trying to just anticipate development, let alone regulate it.<sup>337</sup> In Houston, the Chamber of Commerce did propose several administrative solutions, such as mandating developers provide rights-of-way for future drainage needs.<sup>338</sup> The “Master Flood Control Plan” advocated for by the Houston Chamber of Commerce Flood Control Committee and the Harris County Flood Control District “would allow for the provision of drainage right-of-way in subdivision plats, even when development of the land is far in advance of drainage construction.” Meanwhile, the city of Houston had been planning for the “beautification” of parts of Buffalo Bayou near downtown along the Buffalo Parkway. Designed “to relieve the monotony of a city”, plans for clearing undergrowth, putting down sod, and stabilizing eroding banks would enhance the car-oriented parkway running along the bayou, and it would meet “a definite need for these open green spaces.”<sup>339</sup>

The forceful grassroots environmental response to bayou rectification a decade later was unexpected by Harris County leaders who had been patiently focused on completing drainage projects that had been beset by delays. In contrast to the business-led

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<sup>337</sup> Hardy, “Policy Drought: Water Resource Management, Urban Growth, and Technological Solutions in Post-World War II Atlanta.”

<sup>338</sup> This approach actually became widely used in the Houston area in the 1990s. It has proven only partially successful.

<sup>339</sup> Houston Chamber of Commerce, “Minutes of the Flood Control Committee,” May 14, 1956, Auditors Papers, Harris County Archives. The City of Houston pledged a \$900,000 contribution to this project. Ralph Ellifrit, a city planner, mentioned that this parkway had been a recurrent vision for the city. The first plans for a parkway along Buffalo Bayou date from 1927 and were reprised again in 1941 as part of the city’s flood control plan.

efforts of the 1950s to improve drainage and control pollution, the aesthetic demand of Houston's grassroots groups to preserve the bayous in their natural state was clearly a new perspective brought into the discussion by the activists. Grassroots groups even argued that rectified, concrete channels were not really effective for flood control.

In her dissertation on the "Save Buffalo Bayou Campaign", Teresa Tomkins-Walsh focuses very closely on the coalition of civic organizations and upper-middle class social networks involved in the campaign. She gives a detailed organizational history of the campaign and its legacy in the 1970s and argues that it demonstrated the changing demographics of activists in the late 1960s. As she writes, upper middle class residents represented an "expansion of twentieth-century volunteer conservation to postwar environmental activism."<sup>340</sup> Tomkins-Walsh describes how they turned a "Not-In-My-Backyard" (NIMBY) response to tree-clearing on the banks of Buffalo Bayou into a national example for changing the politics of flood control. They also created a "community" of local environmental organizations that would work on land conservation, air, and water quality issues throughout the 1970s.

The Save our Bayou campaign worked through local representatives to stall the completion of a federal project that the activists thought was not responsive to local needs, at least at the time. The campaign often brought the activists into conflict with Harris County Commissioners and Flood Control District officials, who were still trying to complete the drainage program they had started in the late 1940s. The Save our Bayou campaign, which eventually evolved into the Bayou Preservation Association, achieved

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<sup>340</sup> Tomkins-Walsh, "A Concrete River Had to Be Wrong," v.

its goal after the National Environmental Policy Act (NEPA) was passed in late 1969. As a result, the Corps of Engineers was required to solicit public comments on one of its first Environmental Impact Statements in 1970, and subsequently, the rectification project for Upper Buffalo Bayou was cancelled in 1971. Local efforts at beautification, long proposed, successfully followed in the late 1970s.

My research on flood control in Houston in the 1950s responds to Tomkins-Walsh's study by showing that concerns about over-development, pollution control, and conservation of natural areas started among local officials and business leaders. They recognized these issues and did try to put in place regulations at the local level. In fact, civic and business-led pollution control efforts were widespread during this period. For example, Sarah Elkind writes about the response to choking smog in Los Angeles in the late 1940s.<sup>341</sup> The local Chamber of Commerce represented a coalition of business interests, and it sought to impose *voluntary* thresholds on local industry. Despite grassroots protests that the Los Angeles Chamber was not doing enough, Elkind argues that it became the representative of local concern as Los Angeles County tried to regulate pollution and respond to growing state efforts to do the same.

In Tomkins-Walsh's Houston narrative, the Corps of Engineers and Harris County commissioners were inflexibly tied to the plans for channelizing the bayous that were part of the approved Definite Project Report of 1940. In fact, County Commissioners had to be incredibly persistent in their efforts to modify the Buffalo Bayou Project in the 1950s to include flood control on the county's other bayous.

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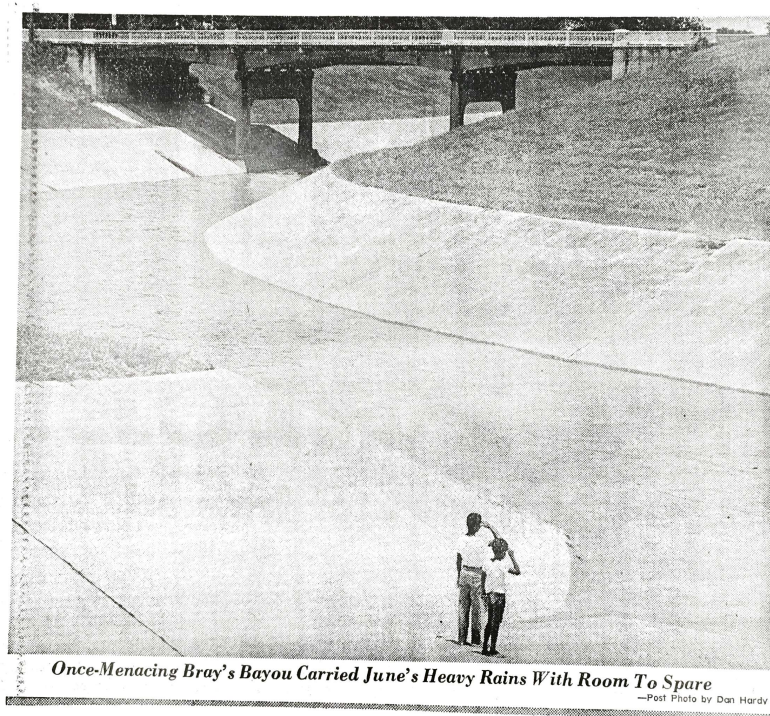
<sup>341</sup> Elkind, *How Local Politics Shape Federal Policy*, 203.

Rectification, it turned out, was actually the fallback position once it was clear that the north and south canals around the city were too expensive to build. Straightening, clearing, and lining the bayou channels through the city was the only obvious solution after the original system could not be completed and suburban flooding continued.

It was this 1954 flood control plan, mostly focused on improving suburban drainage, that the advocates of “conservation” were fighting in the mid-1960s, and the activists likely did not know how much pressure county officials had been under to make improved drainage a reality a little more than a decade earlier. The Save Our Bayou activists thus targeted a flood control project that had been mired in a lengthy federal appropriations process and resistance to local fundraising efforts. It was always on the edge of non-completion, despite the persistence of county commissioners, the Houston Chamber of Commerce, and Corps of Engineers

#### The cancellation of the Upper Buffalo Bayou Project, 1966-1971

When the “Save Buffalo Bayou” campaign began in 1966 it had been a decade since the first federal appropriations were made, and local bonds approved, to finance rectification on Houston’s bayous. Several miles of Brays and White Oak Bayous had been cleared and lined with concrete. Some localized flooding had been prevented through this improved drainage. Now an additional 12 miles of Buffalo Bayou, from Shepard Drive through growing white, middle-class neighborhoods along Memorial Drive all the way to Addicks Dam, would also be cleared by the Corps of Engineers. It was residents of those neighborhoods, seeing trees uprooted and the banks of the bayou carved away to increase the size of the channel, that first spoke out against the project’s destruction of the area’s natural beauty.



*Figure 5.1. Completed rectification on section of Brays Bayou, Houston Post, 1968. Records of the Bayou Preservation Association, University of Houston Libraries.*

Taking action after community meetings organized by Terry Hershey, letters from people living near Memorial Park started pouring into the mayor's office and city planners. Many were from professionals who had recently moved to the Houston area for engineering and medical jobs. They spoke about their perception of Houston as offering beautiful waterways and parks, not a city "riddled with concrete ditches."<sup>342</sup>

Some of the tactics used by the Save Buffalo Bayou campaign were developed by national environmental organizations to fight major civil works projects a decade earlier, such as the Echo Park Dam in Dinosaur National Monument in Colorado. The Sierra

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<sup>342</sup> Ibrahim Sadek to Louie Welch, "Letter Opposing Buffalo Bayou Projects," March 18, 1966, Records of the Bayou Preservation Association, University of Houston Libraries. Sadek was an Egyptian engineer who had recently moved to Houston's Memorial neighborhood to work for Brown & Root.

Club, for instance, which had built resistance to the Echo Park Dam and was campaigning hard against the Corps' flood control projects in the Florida Everglades, sent out material sponsored by the Fisher-Pierce Co (maker of Boston Whaler boats) on how to oppose "wasteful and damaging" civil works projects. Taking cues from a growing intellectual shift against structural flood control, largely associated with the Geographer Gilbert White, these organizations championed land-use restrictions and the preservation of floodplains as natural forms of flood control.

Through the leadership of key activists such as Terry Hershey, the Save Buffalo Bayou campaign had been organized into the Buffalo Bayou Preservation Association (BBPA) by late 1966. Its first director was George P. Mitchell, a petroleum engineer, businessman, and early pioneer in hydraulic fracturing techniques. Mitchell and the BBPA leadership wanted the Corps to again restudy the Buffalo Bayou project to consider if rectification was the only reasonable means of preventing floods. Mitchell also brought BBPA's concerns to Harris County Commissioners. "I am convinced that members of the Commissioners' Court realize the necessity of considering the aesthetic approach in all such projects," Mitchell wrote. "These officials have, I believe, come to realize that we cannot continue just to grow as a big city, paying attention only to the purely utilitarian aspects of our needs and desires."

Mitchell and Hershey's networks in the Houston energy industry increased their political leverage. This was especially true after a new Republican Representative for the west side of Houston, George H.W. Bush, was elected in November, 1966. With the help of Congressman Bush, Terry Hershey appeared before the Public Works sub-committee

on Appropriations in May, 1967. She spoke out against “irreparable damage which would be done to Houston” if the Buffalo Bayou Project continued in its present form.<sup>343</sup>

In a remarkable response, the Public Works sub-committee blocked appropriations to continue work on the bayou clearing for that fiscal year. Perhaps it was recognition of the growing grassroots environmental movement, but more likely competing priorities for other public works funding and a political gesture to Representative Bush were the main reasons for the temporary suspension of funding. Tomkins-Walsh argues that this was a moment of good luck for a freshman representative, from a newly-created district, who knew the right pressure point to hit. It was a tactical victory, not a permanent win. Harris County Commissioners were by now used to the fickle whims of Congress and local voters when it came to supporting flood control. They immediately approved a resolution asking for the funds to be restored.<sup>344</sup>

The BBPA’s next move was to lobby the Harris County Commissioners’ Court as the primary local supporter of bayou rectification. In letters to county commissioners, BBPA leadership, members, and other concerned citizens would question every assumption the second phase of the Buffalo Bayou project was built on. For example, if improved drainage was designed to carry something greater than the 100-year flood through Memorial neighborhoods, perhaps the risk was too small to warrant the current environmentally destructive plan? The primary message to commissioners was that the project needed to be paused and restudied, but if that was impossible, officials must

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<sup>343</sup> Buffalo Bayou Preservation Association, “Newsletter,” June 21, 1967, Records of the Bayou Preservation Association, Box 50.4, University of Houston Libraries.

<sup>344</sup> Tomkins-Walsh, “A Concrete River Had to Be Wrong,” 204.

consider “several possible alternate solutions which would take care of flood control on a reasonable basis, and also leave most of the natural beauty of the Bayou banks relatively untouched.”<sup>345</sup>

Funding the project really became a critical concern for local officials in January, 1968, when another bond referendum failed. Now both federal and local financing was temporarily lacking. The BBPA had won their temporary halt to construction on the bayou. Meanwhile, Representative Bush wrote to the Corps of Engineers about “alternative solutions” that the BBPA had been pushing for. The Corps responded that they were considering techniques such as gabions – basically mesh boxes filled with rocks – to prevent erosion instead of concrete channel-lining.

In July, 1968, yet another bond referendum failed to win voter approval. This one was for \$61 million – about half for roads and half for flood control. After two decades of local fundraising through repeated bond initiatives, Harris County voters were growing increasingly unwilling to support long-term infrastructure efforts, especially ones that could lead to increased property taxes. Without local contributions to purchasing rights-of-way, there was no use for further federal appropriations for construction. The project on Buffalo Bayou would be suspended for another year. And, critically, this vote also directly impacted the HCFCD’s operating budget. “We’ll exist in name only now, because we won’t be able to accomplish anything,” said Tom Langford, the county flood

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<sup>345</sup> Buffalo Bayou Preservation Association, “Newsletter,” June 21, 1967, Records of the Bayou Preservation Association, University of Houston Libraries. Buffalo Bayou Preservation Association.



control engineer. “We now have a free balance available for expenditure of around \$50,000 which isn’t enough to spit across the street with.”<sup>346</sup>

A full year later, in July, 1969, a referendum on flood control bonds finally passed, but this funding for rights-of-way did not allow construction to get much further. Six months later, in January 1970, the National Environmental Policy Act was signed into law by President Nixon. NEPA required federal agencies involved in public works projects to produce Environmental Impact Statements (EIS’s) that would publicly assess damages to ecosystems, wildlife, and human well-being. NEPA required government engineers to gather a lot of new data and consult with a range of experts beyond their own community. Around the country, civil works projects slowed down as the new regulations were integrated into the Corps’, and other federal agencies’, design and review process. One of the first impact statements produced by the Corps would be on the Buffalo Bayou Project.

Meanwhile, in Houston, grassroots environmental groups were organizing around numerous local issues and building coalitions. For example, the group Citizens Who Care sponsored a community education program on air quality issues. Attendees later formed the Citizens’ Environmental Coalition with twenty-seven member groups. The spring of 1970 was clearly the environmentalists’ moment, as a national movement celebrated the first Earth Day in April.

In October, 1970, the Corps published an early EIS on the drainage work for upper Buffalo Bayou. The BBPA was quick to challenge it, along with a range of other

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<sup>346</sup> “Flood, Road Bonds Soundly Defeated,” *Houston Post*, July 28, 1968, Records of the Bayou Preservation Association, University of Houston Libraries.

local and national environmental organizations who saw the threat of litigation as a new frontier in preventing the reckless destruction of natural resources. It would take several years before the Corps could refine the process of preparing these statements and including environmental organizations so that the EIS's were not openly challenged.<sup>347</sup>

In January, 1971, in large part due to the negative response to the Buffalo Bayou EIS, continuing funding shortfalls, and pressure from local representatives in Congress, the Corps of Engineers officially gave public notice that the Upper Buffalo Bayou Project had been cancelled. In February the Corps held a public hearing on the current overall flood control plan for Houston bayous. There were over 200 attendees, thanks to strong turnout by the supporters of preserving the bayous in a more natural state.<sup>348</sup>

The battle for the natural bayou was won, but despite this victory, the war for non-structural flood control in Houston was lost. For example, in the fall of 1970, while the Corps was drafting the EIS, the Citizens Environmental Coalition land-use subcommittee, chaired by Leo Theiss and Terry Hershey, proposed adapting national environmental groups' land-use policy goals to Houston's suburban fringe. The land-use subcommittee also tried to arrange meetings with local government representatives and developers about these goals. These efforts were not particularly successful.

Tomkins-Walsh argues that this policy failure represents the mixed legacy of grassroots environmental action in Houston: they successfully modified the Buffalo Bayou Project, preserving some natural areas and creating parks where only concrete

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<sup>347</sup> Tomkins-Walsh, "A Concrete River Had to Be Wrong," 242; Willingham, "The U.S. Moves towards More Integrative Approaches to Water Resources Management, 1970-2010," 293.

<sup>348</sup> Tomkins-Walsh, "A Concrete River Had to Be Wrong," 250.

ditches were planned, but they also lost the wider policy fight to control development in bayou floodplains.

### **Miami and the campaign to save the Everglades, 1960-1972**

While grassroots groups campaigned to preserve the natural beauty of Houston's bayous, the national environmental movement took up the cause of Florida's Everglades. During the 1960s, the last preserved natural areas of the Everglades would become a site of increasing contention between a growing environmental movement, the C&SF Flood Control District, and federal agencies. With the Central and Southern Florida Project well into its second phase of construction, flood control had evolved into the institutional management of the hydrology of the entire Okeechobee watershed.

After the floods of 1960, South Florida's cyclical weather patterns shifted drastically, and a severe drought started in 1961. It would last for the next four years. The environmental consequences of the prolonged dry spell were very clear in Everglades National Park where dry ponds and desiccated wetlands were littered with the bodies of dead birds, alligators and deer. Shrimp nurseries in the Bay of Florida were decimated.<sup>349</sup> There was no guaranteed allotment of water for the National Park in the Corps' plan, and the C&SF District would not commit to providing any water ration either. The C&SF District justified this position by claiming that its first priorities were for steady water supplies to the Okeechobee agricultural area, now increasingly dominated by large sugar producers, and the still-growing coastal cities.<sup>350</sup> In July 1961 Secretary of the Interior

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<sup>349</sup> Joan A. Browder, "Relationship between Pink Shrimp Production on the Tortugas Grounds and Water Flow Patterns in the Florida Everglades," *Bulletin of Marine Science* 37, no. 3 (1985): 839–56.

<sup>350</sup> Godfrey and Catton, *River of Interests*, 50. Sugar production in the former Everglades had exploded after the Cuban Revolution of 1959 displaced the island's industry and exports.

Stewart Udall wrote a letter to the Corps of Engineers requesting a minimum commitment of water for the National Park from the water conservation areas managed by the C&SF District, but the Corps again refused to make that commitment, claiming that all water rights were held by the Flood Control District.

By 1965, with the C&SF project only a little more than half complete, most of the water that fell as rain on the Kissimmee River, Lake Okeechobee, and the Everglades was channeled, stored, and released by systems administered by the C&SF Flood Control District. Flood control had now completely altered the South Florida landscape. In 1966 the water-cycle reversed, and flooding once again became a problem in South Florida. This time, however, the C&SF District was able to fully protect the Okeechobee farms and coastal suburbs. But by pumping water “uphill” into the Everglades, and filling up the water conservation areas to capacity, the Flood Control District stranded huge deer populations and other wildlife in the remaining dry areas behind the levees.<sup>351</sup>

Conservationists were able to get the Governor to order a halt to pumping, but the C&SF District insisted that pumping was necessary to prevent flooding in the agricultural areas. As the Jacksonville District Corps of Engineers chief told a reporter, “If the large volumes of excess floodwater had not been pumped to the lake and conservation areas the deer situation would have been far overshadowed by headlines citing a disastrous flood in both urban and agricultural areas of south Florida.”<sup>352</sup> As tensions between these competing priorities increased, pressure mounted for a modification to the C&SF project

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<sup>351</sup> Godfrey and Catton, 55.

<sup>352</sup> *Godfrey and Catton*, 56.

that would control floods, ensure fresh water supplies, and also protect the natural resources of the Everglades.

In 1968 the Corps of Engineers completed a restudy of the original C&SF project, now 19 years old. The restudy emphasized restoring water supplies to Everglades National Park, but it required conveyance canals and additional pumping stations to pump excess water from the remaining coastal agricultural areas westward into the Everglades. Planning around the needs of the National Park was a significant change in the Corps of Engineer's priorities in response to growing environmental awareness. Activist groups at the state level, particularly the Florida Audubon Society, were pushing the issue of Saving the Everglades into the national conversation. The image of dead birds in South Florida echoed with stories of wildlife harmed by pollution in other coastal states.<sup>353</sup> The restudy of the C&SF project still did not mandate a definite amount of water to the park, but "this reiteration of the promise in the C&SF Project plan, although somewhat vague, showed that the drought of the 1960s and the work of park proponents was having some effect on the Corps' perception of how the project should be operated," Godfrey and Catton write in *River of Interests*. "It was a small step, but it set the stage for congressional leaders, such as Senators Gaylord Nelson and Edmund Muskie, to resolve the situation."<sup>354</sup>

The Flood Control Act of 1968 authorized the modifications recommended by the Corps' restudy of the C&SF Project. These modifications alone would cost an additional

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<sup>353</sup> David L. Sills, "The Environmental Movement and Its Critics," *Human Ecology* 3, no. 1 (January 1, 1975): 1–41.

<sup>354</sup> Godfrey and Catton, *River of Interests*, 62.

\$70 million. There was still no formal commitment from the Corps of Engineers for how much water would be delivered to the National Park, but there was an understanding between the Department of the Interior and the Department of the Army that the Corps would provide at least 315,000 acre-feet of water to the park annually. The State of Florida and the C&SF District still refused to guarantee a specific supply of water.

Environmental concerns were forefront on the national stage by 1970. The National Environmental Policy Act was signed in January and the first Earth Day was celebrated in April. Gaylord Nelson, a senator from Wisconsin and sponsor of NEPA and the Earth Day demonstrations, remained interested in the drama of the Everglades, and he held hearings that year on the modifications to the C&SF Project. Nelson expedited a more formal agreement by withholding Congressional appropriations for the C&SF project until the National Park Service, the State of Florida, and the Corps of Engineers could finalize their negotiations about exactly how much water the park would get.

By the early 1970s, however, the drama of saving Everglades National Park was equaled by concerns about the impacts of over-population along the Southeast coast of Florida. In the 1950's South Florida's population had more than doubled. In 1960 Dade County's population was approaching a million people, and planners optimistically projected that the population of the Miami area would double again by 1970. It was projected to eventually reach 4 million by 1980. While Dade County did not grow quite as expected, the Southeast Florida region as a whole did experience nearly 50 percent growth during the 1960s, and the population reached 2.3 million people by 1970 and 3.3

million by 1980, creating a regional megacity from the northern keys to the Palm Beaches.<sup>355</sup>

The demographics of Miami were changing rapidly as well during this period. Waves of immigration from Latin America, and especially from Cuba after the communist takeover in 1959, created more diverse inner city neighborhoods while white suburbs sprawled further south and west into former agricultural lands.<sup>356</sup> Dade County officials had stopped acting so surprised at the speed of suburban development. The region had been under a metropolitan Miami-Dade government for more than 12 years, and the bureaucratic infrastructure was in place to begin thinking about how to manage the scale of South Florida's growth. With the dramatic increases in population, the unintended consequences of the flood control projects started to become clearer.

#### The Environmentalists' moment, 1972

Another severe drought started in 1970 and lasted for the next 18 months. The large population of Dade and Broward counties drew down groundwater supplies to critical levels, and county managers had to ask the C&SF District to pump surface water from the conservation areas to prevent salt-water intrusion into the county's well fields. The Greater Miami Chamber of Commerce called on communities across the region to start making plans to limit water usage in anticipation of the next drought.<sup>357</sup> Meanwhile

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<sup>355</sup> Stanley K. Smith, "Florida Population Growth: Past, Present and Future" (Bureau of Economic and Business Research, University of Florida, 2005), [https://www.bebr.ufl.edu/sites/default/files/FloridaPop2005\\_0.pdf](https://www.bebr.ufl.edu/sites/default/files/FloridaPop2005_0.pdf).

<sup>356</sup> Alejandro Portes and Alex Stepick, *City on the Edge: The Transformation of Miami* (Berkeley: Univ. of California Press, 1994), 148.

<sup>357</sup> David Blumberg, "Draft Letter to South Florida Chambers of Commerce," November 16, 1971, HistoryMiami, Jeanne Bellamy Water Resources Collection. Among the more interesting proposals from the Chamber of Commerce's Water Task Force was "cloud seeding" to prevent future water shortages. The C&SF District responded that cloud seeding was an "unreliable" solution to droughts,

in Lake Okeechobee farms drained away so much water that portions of the muddy bottom of the lake were exposed and started to dry out.<sup>358</sup>

Water shortages were followed by another environmental crisis in Lake Okeechobee as fertilizer runoff from farms in the Kissimmee River watershed increased phosphorous pollution in the remnants of the lake. Lack of water meant that there was no easy way to dilute the runoff. Algae thrived on this missing element, which was normally in short supply, and bloomed spectacularly, using up most of the available oxygen in the lake and producing toxic effects. Lake Okeechobee, Indian River, and St. Lucie River recreation and fishing collapsed. Beaches near outlet canals stank from dead algae and fish. This disaster was partly due to the third phase of the C&SF project which had straightened out the Kissimmee River, drained wetlands, and allowed more runoff to move more quickly into Lake Okeechobee. Flooding of ranches in the Kissimmee Valley was under control, but the downstream consequences were just beginning.

In response, newly-elected Democratic Governor Reubin Askew called for a Conference on Water Management in South Florida.<sup>359</sup> Although he had been a state senator from Pensacola since 1962, Askew appealed to a South Florida electorate no

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at best, but in the early 1970s NOAA research on this technique in South Florida was quite serious. More realistically the Water Task Force recommended that water from the conservation areas pumped southward to protect the city's well fields. And they wanted the Chamber of Commerce to put pressure on the federal government to finish the next stage of works around Lake Okeechobee so that the lake level could be raised. The C&SF District responded to these recommendations saying that their priority was also to keep saltwater out of the Biscayne Aquifer. Their approach was to keep water levels high in the canals in Dade County, so that fresh surface water would put enough pressure to prevent salt water from infiltrating the limestone. The C&SF District also supported "deep storage and recovery of storm-water runoff" in Dade County, although this solution also brought fears of contaminating the aquifer.

<sup>358</sup> Environmental Quality Action Committee, "Drought Briefing."

<sup>359</sup> Reubin Askew, "Letter to Jeanne Bellamy," August 31, 1971, HistoryMiami, Jeanne Bellamy Water Resources Collection.



longer closely tied to the state's rural past. Askew was the first Florida governor to really benefit from the new political order in Florida after years of northern counties controlling politics through the malapportioned state legislature. Although the state legislature had been reapportioned after 1962 to reflect the massive population shift to South Florida, it took nearly a decade for those demographic changes to be reflected in the political orientation of the state's leaders. Askew was a steady, consistent public servant where the former Governor, Claude Kirk, had been an entirely unpredictable one. Askew vowed to end the last vestiges of the Pork Chop Gang's influence on state politics by instituting ethics reforms.<sup>360</sup>

In 1971, Governor Askew came into office in a moment of critical environmental concern.<sup>361</sup> In his view, the problems in the Everglades that got the most public attention, the "drowning wildlife and muck fires" were really "only symptoms of the larger, long range problems we face." Chief among those were projected chronic water shortages and saltwater contamination of the groundwater supplies.

The Governor's Conference on Water Management in South Florida included journalists, such as Jeanne Bellamy, and civic leaders who had originally championed the C&SF projects and now were concerned about the transformations that rapid population growth had caused in South Florida. The Governor's Conference also included several prominent conservation activists, such as ecologist Arthur Marshall, who felt that the

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<sup>360</sup> Steve Bousquet, "Former Florida Gov. Reubin Askew Dies at 85," Tampa Bay Times, March 13, 2014, <http://www.tampabay.com/news/obituaries/former-florida-gov-reubin-askew-dies-at-85/2169973>.

<sup>361</sup> Bousquet.

natural Everglades had never been given a strong enough priority in the Corps of Engineers' original designs.

The final statement from the conference was a dramatic change in rhetoric about the state's development. "There is a limit to the number of people which the South Florida basin can support and at the same time maintain a quality environment," the statement declared.<sup>362</sup> Only with more regulation over the location and pace of development, as well as the management of water resources, would Florida be able to continue to grow.<sup>363</sup>

Following the conference, Governor Askew championed a Water Resources Act for Florida.<sup>364</sup> It called for new Water Management Districts to broadly regulate all of the State's watersheds. The Water Management Districts would have the power to issue permits for large water users in their jurisdictions.<sup>365</sup> Most importantly, the act setup a \$240 million fund for local governments to use to purchase environmentally-sensitive

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<sup>362</sup> Governor's Conference on Water Management in South Florida, "Statement to Governor Reubin O'D. Askew," 1971, Jeanne Bellamy Water Resources Collection, 1.1, HistoryMiami.

<sup>363</sup> Governor's Conference on Water Management in South Florida, 4; John Marshall, "Guide to the Arthur R. Marshall, Jr. Collection," Everglades Digital Library, Florida International University, 1998, <http://www.gatewaycoalition.org/files/everglades.fiu.edu/marshall/index.html>. Arthur Marshall was a biologist for the US Fish and Wildlife Service from 1955-1969. In 1970 he became Director of the Division of Applied Ecology at the University of Miami. He would later serve on the Governing Board of the C&SF District. During this period biologists' concern about the relationship between human population and the "carrying capacity" of local ecosystems was part of an international discussion on the *limits to growth*. Arthur Marshall identified himself as a "systems thinker" along with the MIT scientists who had modeled the relationship between population, resources, and pollution for the Club of Rome in 1972. In that sense, the potential water shortages in South Florida, the ecological damages to the Everglades, and the rapid development of the Southeast coast became a case study in broader trends that many of these scientists saw as leading to the collapse of global civilization. The language of the final statement from the Governors' Conference reflects this preoccupation with growth outstripping resources, leading to catastrophe.

<sup>364</sup> The impacts of the Florida Water Resources Act of 1972 were important to the management of groundwater supplies in the Tampa area. I focus on this particular issue more extensively in Chapter 3.

<sup>365</sup> Swihart, *Florida's Water: A Fragile Resource in a Vulnerable State*, 48.

lands. By 1977, the C&SF Flood Control District was renamed the South Florida Water Management District (SFWMD).

The Corps of Engineers had wanted to use Lake Okeechobee itself as a source of fresh water, both to maintain supplies and to keep salt water out of the aquifers. In order to transform Lake Okeechobee into a better reservoir, the Corps needed to increase the water level in the lake. But where was the water going to come from? The Corps came up with a system that could pump water back into the lake from agricultural and water conservation areas to the south. This pumped water was full of fertilizer and other pesticides. Additional polluted water continued to flow into Lake Okeechobee from Kissimmee River which had lost most of its wetland capacity to filter that runoff.

Environmentalists were determined to save Lake Okeechobee and insisted the back-pumping from agricultural areas be stopped, even if a higher lake level helped better insure the supply of fresh water. Meanwhile sport fishing and recreation groups resisted the SFWMD's attempts to dump excess fresh water from the polluted lake using the northern outlet canals on the East Coast. Only during periods of severe flooding would it be necessary to drain off excess water in the lake. Meanwhile it was clear that nobody wanted the polluted water, and the filtering value of the marshes of the Kissimmee and Northern Everglades had been greatly underestimated.

#### Water Supply Woes, 1975-1981

In the 1980's President Reagan began a policy of weakening the environmental regulations of the 1970s, while simultaneously putting states in greater charge of civil

works projects.<sup>366</sup> In 1982, the General Accounting Office harshly reviewed the remainder of the C&SF Project which seemed stuck between trying to complete its original 1954 designs and planning for environmental modifications that had been proposed in the 1970s.<sup>367</sup> Meanwhile environmentalists in South Florida had another advocate in Governor Bob Graham, who had come into office in 1979 after years of campaigning to “Save the Everglades” in the State Senate.

Local environmental concerns combined with federal spending constraints produced a greater focus on “non-structural” solutions to flood control and water supply that worked with natural conditions instead of trying to fundamentally alter them. These kinds of solutions were particularly championed by the new St. Johns River Water Management District that had one of the most limited property tax bases to draw from.<sup>368</sup> Approaches such as buying land in floodplains and restricting development around them were also used by the Southwest Florida Water Management District when funding dried up for the Four River Basins Project.

Most critical to Miami-Dade County managers was assuring the supply of high quality drinking water as the region’s population grew. Miami drew from wells in the Biscayne Aquifer which pooled underneath the eastern half of the former Everglades. Water from much of the Lake Okeechobee watershed slowly trickled through limestone to recharge the aquifer. As the Corps and SFWMD channeled, ponded, and shunted water

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<sup>366</sup> Godfrey and Catton, *River of Interests*, 111.

<sup>367</sup> US GAO, “Report to the Secretary of the Army: Improved Planning and Management of the Central and Southern Florida Flood Control Project Is Needed,” May 14, 1982, Records of the Office of the Chief of Engineers, Jacksonville District, NARA Atlanta.

<sup>368</sup> Swihart, *Florida’s Water: A Fragile Resource in a Vulnerable State*, 103.

to the Atlantic Ocean, the aquifer could not recharge, and the demand for fresh water from Miami and Fort Lauderdale drew it down much faster than it could have recharged under the best natural conditions before the flood control projects.<sup>369</sup> As the Biscayne aquifer was drained of fresh water, salty brackish water from adjacent aquifers nearer the coastline began to infiltrate the municipal water supply. Miami's drinking water was also being polluted by heavy organic loads from algae and "muck" that thrived on runoff from sugar fields and farms in the agricultural reserve near Lake Okeechobee.

Fort Lauderdale in neighboring Broward county also drew water from the Biscayne Aquifer, and its water supply challenges were even more acute. In 1981 the Environmental Coalition of Broward County and the Friends of the Everglades held three forums on drinking water quality and its relationship to water conservation. At one of those forums ecologist Arthur Marshall, after stepping down from the Governing Board of the SFWMD, spoke passionately about the unintended impacts of the flood control projects on drinking water supplies in Southeast Florida. For Marshall, the ecological problems in the Everglades and the water supply problems on the southeast coast were inherently connected.<sup>370</sup> At the forum Marshall described his own "Marshall Plan" to restore the natural flow of water through the Everglades, and thus secure a more reliable supply of fresh water for the cities on the southeast coast. In the decades since then, the Corps of Engineers has implemented many elements of the "Marshall Plan" – at a

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<sup>369</sup> Garald G. Parker, "The Biscayne Aquifer," in *Handbook on the Biscayne Aquifer: Water Management, Water Conservation, Health and Cost of Drinking Water*, ed. Brian Blackwelder, Brenda Marineace, and Joseph E. Podgor (Environmental Coalition of Broward County, Inc., 1981).

<sup>370</sup> Arthur R. Marshall, "A Critique of Water Management," in *Handbook on the Biscayne Aquifer: Water Management, Water Conservation, Health and Cost of Drinking Water*, ed. Brian Blackwelder, Brenda Marineace, and Joseph E. Podgor (Environmental Coalition of Broward County, Inc., 1981).

significantly greater cost than achieving flood control in the first place. These restoration projects were essentially a “re-plumbing” of the entire drainage system.<sup>371</sup>

### **Tampa and the deactivation of the Four River Basins Project, 1965-1981**

During the same period in which grassroots environment groups were fighting the rectification of Houston’s bayous and trying to protect the remaining Everglades in the Miami area, progress on Tampa’s flood control system was becoming increasingly difficult. The national environmental movement that had gained momentum in the late 1960’s resulted in transformative legislation at the federal level that changed the process through which the Corps of Engineers designed projects.<sup>372</sup> NEPA’s mandatory Environmental Impact Statements became required of state agencies as well. At agencies like the Southwest Florida Water Management District, NEPA opened the door for greater input from environmental advocacy groups that could demand measures be put in place to safeguard natural resources and reduce ecosystem damages from some projects. These groups could even sue states and government agencies over the thoroughness of EIS’s. Legal action became a powerful tool to stall many federal projects for years.<sup>373</sup> Interestingly, the SWFWMD started working with ecologists at USF to prepare EIS’s in 1969, before they were required by the federal government, on projects such as the Tampa Bypass Canal.<sup>374</sup>

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<sup>371</sup> Mark Alpert, “Replumbing the Everglades,” *Scientific American* 281, no. 2 (August 1999): 16–18, <https://doi.org/10.1038/scientificamerican0899-16>.

<sup>372</sup> Willingham, “The U.S. Moves towards More Integrative Approaches to Water Resources Management, 1970-2010.”

<sup>373</sup> Robert A. Kagan, *Adversarial Legalism: The American Way of Law* (Harvard University Press, 2003).

<sup>374</sup> Twachtmann, Interview with Dale Twachtmann on Water Management.

In 1971, Tampa was also feeling the effects of South Florida's prolonged drought. All the growth of the 1960s had put considerable pressure on water resources. Meeting the demands of uninhibited population growth, while reducing the pollution of Florida's recreational areas, was central to voters. Governor Askew's response, and his lasting environmental legacy, was the Water Resources Act of 1972 that led to the creation of regional Water Management Districts for the entire state following the model of the SWFWMD.

The past success and failures of flood control in the Miami and Tampa areas influenced the new water management districts of the 1970s. As former SWFWMD Chair Derrill McAteer noted, in the early 1970s the new water management districts were trying to distance themselves from the old, expensive, infrastructure-dependent model of the C&SF Flood Control District, a model that had initially been tried at the SWFWMD for the Four River Basins. "...the kind of things that they would do were the old way," McAteer recalled. "We were trying to go to a new way. So there was not a whole lot of compatibility in our positions in Tallahassee and elsewhere."<sup>375</sup> Without support for large federal projects, water management worked under very different principles in other parts of the state. For example, the sparsely populated, hilly Suwanee River District in north Florida has never built any works on their namesake river.<sup>376</sup>

The 1970's would see the shelving of most of the structural components of the Four River Basins. Over the next decade, the Cross-Florida Barge Canal, and many of the other flood control and water storage components still planned for the C&SF Project,

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<sup>375</sup> McAteer, Interview with Derrill McAteer, 24.

<sup>376</sup> Swihart, *Florida's Water: A Fragile Resource in a Vulnerable State*, 1.

were also cancelled. By the mid-1980s, the change in engineering paradigm, environmental resistance, and finally economic limitations, had severely curtailed the designs for the flood control system that had been envisioned two decades earlier. By 1985, the South Atlantic Division Engineer in Atlanta had listed most of the reservoirs and canals to be moved to “inactive” status, although they were not decommissioned.<sup>377</sup>

With most federal projects completely stalled, the Water Management Districts would use many strategies to carry out their expanding missions, and they would become more deeply involved in ensuring the stability and quality of fresh water supplies. The Corps of Engineers did not put projects such as the Barge Canal on the “inactive list” lightly. There were years of restudies and testimony before Congress. But the Jacksonville District had many other projects in Florida that had more urgency and local support: deepening channels and harbors, completing the intracoastal waterway, and restoring eroded beaches.

The following sections detail key campaigns for grassroots environmental groups in the Tampa Area and northern Florida.

#### Defeating the Tampa Bay fresh water lake plan (1965 - 1968)

During the drought of the early 1960’s one of the most controversial ideas to prevent salt water intrusion into the Floridian aquifer had been to impound part of Tampa Bay and turn it into a fresh water lake. As water managers began to understand how quickly aquifer levels were being drawn down as St. Petersburg’s usage increased, there

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<sup>377</sup> It is still unclear why most of the reservoirs in the Tampa Bay Area were shelved. While the factors I pointed to – budget constraints, environmental pushback, and alternative approaches – were all certainly relevant, I do not have confirmation of why and how that decision was made.



was increasing urgency to prevent contamination of the regional water supply. As former SWFWMD Executive Director Dale Twachtmann recalled, “First of all, hydrology had shown up, because I thought we should protect those wells that were up in northwest Hillsborough County. By holding all the fresh water possible on the land, that would help those wells. Help, not necessarily the wells, but help the whole situation.”<sup>378</sup>

Engineers working for Hillsborough and Pinellas counties proposed building a dike across the northern end of Old Tampa Bay and refilling that area with fresh water. In theory, the higher level of fresh water near the coast would provide enough pressure to prevent salt water from getting into the region’s water supply. The large, \$4.5 million project was going to be financed entirely locally, without federal support. As the plan came closer to execution in the summer of 1965, an array of groups, led by scientists from the University of South Florida, organized to prevent catastrophic environmental damage to the bay. Organizations such as the Save Our Bays Committee passionately argued that all marine life in that section of the bay would be killed and a critical breeding ground for shrimp and fish would be ruined. As fresh water increased in the bay, the stink of rotting algae would ruin the aesthetics and recreational value of the bay front. Furthermore, these groups painted the plan as taxpayer dollars serving developers who would try to build on newly-reclaimed land dredged from the former bay area.

William Taft, a geologist from USF who led the Save our Bays Committee, went on local TV to argue that even the main justification for the project was wrong because the level of the lake could not be maintained high enough to prevent saltwater from

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<sup>378</sup> Twachtmann, Interview with Dale Twachtmann on Water Management, 18.

getting into the aquifer. “If salt water intrusion is the argument - you are being taken,” he claimed. “If you taxpayers feel the way we do – that the smell from these arrangements is stronger than that from the mud flats of upper Tampa Bay – will you please help us?”<sup>379</sup> The defeat of the freshwater lake plan was one of the first major environmental successes in the region and started a trend towards questioning the motives of large water projects, including ones sponsored by local authorities.

In his first years at the district, Dale Twachtmann had spent a lot of time fighting with environmentalists over plans for the Four River Basins, but on the fresh water lake issue, he ended up changing his mind after numerous meetings with conservationists such as USF’s William Taft. “One day I just decided, I think they’re right,” He recalled. “I had been arguing with them, and I got to just really dislike them because they were so nasty, and [their implying] that we were stupid and they were smart. The attitude was awful. But I came to believe they were correct.”<sup>380</sup>

Although the fresh water lake plan may have failed, pollution in Tampa Bay continued to be problem in the 1960s. The same political transformations that supported the nonstructural, floodplain management approach to flood control in Southwest Florida also brought concerns about heavy pollution in Tampa Bay. In 1969, the federal government ordered Tampa to “clean up its act.” As director of Tampa’s Public Works,

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<sup>379</sup> William Taft, “Editorial: Fresh Water Lake Answer,” June 2, 1965, Sam Gibbons Papers, University of South Florida Libraries.

<sup>380</sup> Twachtmann, Interview with Dale Twachtmann on Water Management, 18. Twachtmann also showed his own growing awareness of conservation issues, and particularly about the wildlife of the Tampa area. “I was very fond of the nesting grounds for the brown pelican,” he said. “One other biologist had said, that’s the nursery area for the whole Gulf of Mexico. I wasn’t believing half of what I heard. But it was, not untypical in those days, environmentalist overkill, which we learned there was a lot of. But they were making their points.”

Twachtmann sought to develop a new water treatment plant at Hookers Point on the Hillsborough River. It would be a \$170 million facility capable of cleaning sewage to the point where it could be released in Tampa Bay without causing nitrogen contamination. Twachtmann was widely praised by environmentalists for his role in restoring the health of Tampa Bay in the 1970s. He eventually became Secretary of the Florida Department of Environmental Regulation in 1987.<sup>381</sup>

#### The defeat of the Cross-Florida Barge Canal (1974-1981)

Perhaps the greatest environmentalist victory of the 1970s in Florida was the demise of the Cross-Florida Barge Canal, a project with direct implications for the remnants of the Four River Basins system. The dream of a bulk shipping short-cut across the Florida peninsula had morphed into an active project during the 1930s. Congress approved funding for the project during World War Two, but major construction on the 185-mile long system of canals, locks, and dams did not start until 1964. President Johnson, following on promises made by John F. Kennedy to build the canal, presided over the groundbreaking ceremony.<sup>382</sup> When completed it would connect the Atlantic Intracoastal waterway from southern Georgia to the Gulf of Mexico on the Florida panhandle. Its supporters, who included most of Florida's elected officials in the early 1960's, promoted the project as "Main street, U.S.A."<sup>383</sup>

In 1966 the Corps of Engineers started work on the first major dam on the Oklawaha River outside of Gainesville, Florida, which inundated wetlands and forests to

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<sup>381</sup> Fox, "Dale Twachtmann, First Head of Swiftmud, Dies at 83."

<sup>382</sup> Godfrey and Catton, *River of Interests*, 72.

<sup>383</sup> Canal Authority of Florida, "Cross Florida Barge Canal," 1969, State Archives of Florida, [https://www.floridamemory.com/FMP/broadsides/large/s501\\_b005\\_f14\\_02\\_01.jpg](https://www.floridamemory.com/FMP/broadsides/large/s501_b005_f14_02_01.jpg).

create Lake Oklawaha.<sup>384</sup> The new lake soon began to fill up with water hyacinths and choking algae blooms as the natural flow of fresh water was impeded by the dam. Environmentalists, led by Marjorie Carr, the wife of a University of Florida zoologist, and the Florida Audubon Society, were dismayed at the appearance of these first environmental damages, and vowed to stop the completion of other segments of the barge canal.

In 1969 they formed Florida Defenders of the Environment. Working with national environmental organizations such as Environmental Defense Fund, the group used a new tactic to stop civil works projects and major polluters: they sued the Corps of Engineers for destroying the natural resources of the Oklawaha River without having fully studied the social costs and benefits of their project. Years of litigation and political maneuvering followed. During this period, large environmental organizations were learning the power of litigation to delay civil works projects around the country.<sup>385</sup>

Meanwhile, the grassroots campaign against the barge canal gained statewide, and eventually, national attention. It was a period of exceptional environmental awareness and high-profile events such as the fire on the Cuyahoga River and the Santa Barbara oil spill. In January, 1971, President Nixon ordered a stop to construction on the canal. It is likely that political considerations for his re-election campaign were at least part of the decision, but his statement reflected the change in the calculation of costs and benefits. The Cross-Florida Barge Canal “was conceived and designed at a time when the focus of Federal concern in such matters was still almost completely on maximizing economic

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<sup>384</sup> Godfrey and Catton, *River of Interests*, 73.

<sup>385</sup> Kagan, *Adversarial Legalism: The American Way of Law*.

return,” Nixon’s statement read. “In calculating that return, the destruction of natural, ecological values was not counted as a cost, nor was a credit allowed for actions preserving the environment.”<sup>386</sup>

By 1977 the State of Florida withdrew its support from the Barge Canal. Even the Corps of Engineers own environmental impact study did not recommend completion of the waterway. It was a huge success for coalitions of environmental organizations in Florida, a demonstration of how greatly state politics had changed, and a profound transformation of public opinion for a project that had enjoyed widespread support only ten years earlier.

The decade that led to the demise of the Cross-Florida Barge Canal also witnessed the cancellation of most of the structural components of the Four River Basins Project. In 1961 initial planning for the Four River Basins had assumed the Barge Canal would be under construction in the next few years and operational by the 1970s. Flood control on two of the Four Basin’s rivers, the Withlacoochee and Oklawaha, depended on the barge canal system as an outlet.<sup>387</sup> Former SWFWMD Director Dale Twachtmann recalled testifying before Congress to at least preserve that function of the system. “I...said,

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<sup>386</sup> Richard Nixon, “Statement About Halting Construction of the Cross Florida Barge Canal,” ed. Peters Gerhard and John T. Woolley, January 19, 1971, The American Presidency Project, <http://www.presidency.ucsb.edu/ws/?pid=3044>. Dale Twachtmann recounts an interesting personal story about his friendship with John Ehrlichman – Assistant to the President for Domestic Affairs under Nixon – and how the Barge Canal was actually cancelled. “He [Ehrlichman] said the President didn't even know it. He said, I was getting so much mail and people were raising so much hell, and one day I just put out this news release that we were stopping it. And to my knowledge it is the only public works project that's ever been stopped with a news release. But Ehrlichman said he did it. Told me in my own living room one night, and the President the next day talking to him, or two days later said, what's going on in Florida about stopping the Barge Canal? He said, Mr. President, do you want me to bring you the stacks of stuff that's coming in that this is awful, it's going nowhere, so I stopped it. That's what he said he said. And the president said, well, okay, and it stayed stopped. I didn't know all that until twenty years later.”

<sup>387</sup> US Army Engineer District, Jacksonville, “Conference Summary on Four River Basins Survey.”

please let this much of it continue on the east end and this much of it continue on the west end because we are planning the whole Four River Basins Project to let the flood out of the Oklawaha and the Withlacoochee Rivers. And if you stop it, the flood control project won't work and we won't have channels to let the water out.”<sup>388</sup>

“Water wars”: The consequences of the failure of the Four River Basins project (1974-1985)

Since the 1930s, the city of St. Petersburg, trapped on its peninsula between the Gulf of Mexico and brackish Tampa Bay, depended entirely on wells in Hillsborough county and a long pipeline to bring fresh water across the bay to the city. As the water table receded in drought years, and salt water moved in from the bay, concerns about water quality increased. The city of Tampa, however, still relied on the Hillsborough River as its primary water source, and during minor flood conditions, a lot of that surface water still ended up going into Tampa Bay.<sup>389</sup> Tampa, St. Petersburg, and Clearwater were all old urban centers that had seen nearly a doubling of their population between 1950 and 1960, with much of that growth immediately outside of the urban core.

As St. Petersburg’s need for water increased, the city began to pump groundwater that was now needed in suburban Hillsborough County. Dale Twachtmann recalled consulting with hydrologists to really understand the stocks and flows through the limestone aquifer. This outside expertise helped the SWFWMD intervene in the usage

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<sup>388</sup> Twachtmann, Interview with Dale Twachtmann on Water Management, 29. The outlet for the Oklawaha was never completed, but the bypass channel for the Withlacoochee was finished and operated in Citrus County using federal appropriations. It’s now part of the Cross-Florida Greenway.

<sup>389</sup> Harold Tyler, “Florida’s Water: How Long Will We Have Enough?,” *Tampa Tribune*, May 14, 1967, Box 2, Accession No. 077-02-0045, RG 77, National Archives at Atlanta.

disputes between counties. "...then we joined in battle with the city of St. Petersburg and Pinellas County about their wells in northwest Hillsborough County," Twachtmann recalled, "because we as a district were saying, look, you can say it's drought, and we agree it isn't raining like it used to, but you are causing effects on the surface... Like, cypress trees would just fall over. Lakes would go dry. They didn't want to believe that. They always fought it. They continue to fight it. They were afraid of losing their wells, and they didn't have any other water supply."<sup>390</sup>

Suburban growth in rural areas of the Southwest coast of Florida had been relatively sedate compared to the rapid development in the Miami area on the other side of the peninsula. During prolonged droughts in the early 1960s, and again in the 1970s, more wellfields had been developed to supply irrigation for citrus farmers and newer subdivisions. At first, the SWFWMD just collected information from private well drillers – how many wells they had dug and the dimensions of the pipes they were using. Water Managers did not have any regulatory authority, and they needed data on usage before they could push for that authority. "Those numbers were startling," Dale Twachtmann recalled. "I think that helped, in the long run, for the laws that came later, which did put the water management districts in the consumptive-use permitting business."<sup>391</sup>

Even without state authority, SWFWMD began attempting to regulate withdrawals from wellfields in Hillsborough county in 1968, and almost immediately there was resounding opposition from St. Petersburg and Pinellas County. The Water Management District was accused of "shutting down the growth in Pinellas County and

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<sup>390</sup> Twachtmann, Interview with Dale Twachtmann on Water Management, 19.

<sup>391</sup> Twachtmann, 28.

trying to move it to Pasco and Hillsborough,” former Chairman Derrill McAteer recalled. “Which is a basic lie. We had no thoughts at that point of shutting down Pinellas County.”<sup>392</sup> But they did campaign heavily for authority from the state to legally regulate groundwater withdrawals from the aquifer.

McAteer further recalled that St. Petersburg and Pinellas County were “pumping the guts out of” the aquifer, and county commissioners were coming in to Governing Board meetings and demanding that the SWFWMD take some regulatory action.<sup>393</sup> The State of Florida Water Resources Act of 1972 gave the SWFWMD the official power to control how much water was being drawn out of the Floridian Aquifer.<sup>394</sup>

In 1972 Dale Twachtmann was hired away from SWFWMD by Tampa mayor Dick Greco to run the city’s public works. It was regarded as a “major coup” by environmentalists since Twachtmann was now a “statewide expert on water problems”.<sup>395</sup> Surprisingly, Twachtmann’s first move was to secure more reliable water supplies for the city than its historic source, the Hillsborough River, by developing a new wellfield in areas that the Water Management District was trying to protect for water conservation purposes. This was exactly the kind of pressure on groundwater supplies that he had tried to regulate at SWFWMD. But the drought of the early 1970s was dire; Twachtmann recalled that on his first day on the job, Mayor Greco told him that the shortage was so acute that Tampa General Hospital had lost water pressure on the upper floors. “The city

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<sup>392</sup> McAteer, Interview with Derrill McAteer, 6.

<sup>393</sup> McAteer, 6.

<sup>394</sup> Southwest Florida Water Management District, “The 1960s — The District’s Beginning.”

<sup>395</sup> Abby Kaighin, “Twachtmann Gets Water and Sewer Post,” *Tampa Times*, October 4, 1972, University of Florida Libraries.



was drinking the whole Hillsborough River, and the dam was letting nothing through,” Twachtmann said. “So we had to have another place to go. So...I got going the concept to build that well field in the SWFWMD lands, which a year or two earlier I had suggested to the city of Tampa, that they could have that land for a well field. So the irony was that I had to live with my own rules.”

Obviously the Water Management District’s power to issue permits, and thus partially regulate groundwater withdrawals, did not solve the intercounty water supply disputes in the early 1970s. One idea that was floated at the time was for SWFWMD to become an overarching public utility for the entire Tampa Bay Area. Derrill McAteer felt it was going to be an impossible situation for the Water Management District to become a water supplier as well as the state-mandated regulator of groundwater usage. “Nobody would have trusted us,” he said. “Everybody thought we were favoring somebody else...I did not want the District to be both the regulator and the supplier. My God, what would we have been? We’d have been a monster of all monsters.”

Demand for water increased dramatically in the 1980s because of rapid population growth in the Tampa Bay Area. Tampa took off in the 1980s just as Miami was reaching its own limits to growth, ones defined by its own flood control system that separated dry land from water conservation areas. After decades of expansion, the Miami area had limited remaining land for cheap development. Between the ocean and the remaining Everglades there were few rural areas left for the suburbs to expand. Waves of immigrants from the Caribbean reshaped Miami’s older neighborhoods, and the perception of rampant crime, drug trafficking, and the aging of Miami Beach greatly

reduced the attraction of the southeastern Gold Coast.<sup>396</sup> But on the other side of the state rural areas around Tampa seemed untouched by these forces.

Developers again began building large retirement communities along the newly-completed interstates: south of Tampa on I-75 and northeast towards Orlando on I-4. Between 1970 and 1980, the population of the Tampa-St-Petersburg-Clearwater MSA increased by 50 percent to more than 1.6 million residents.<sup>397</sup> Pasco County, immediately north of Tampa's Hillsborough County, which had only a little more than 36,000 residents in 1960 during the floods, had a population of nearly 200,000 by 1980. One of the biggest challenges for these new population centers was bringing in enough fresh water.

Another solution to Tampa Bay Area water competition had been to combine municipal utilities into a new, regional organization. In the summer of 1974 - the same summer that the Green Swamp was designated a state area of critical concern - SWFWMD Executive Director Don Feaster presented plans for an interconnected water system to local politicians at a Tampa Bay Regional Planning Council meeting. At the time he admitted that the plan was still a "massive pipe dream".<sup>398</sup> A few months later, however, the State of Florida authorized an amendment to the Water Resources Act that would allow local government to create "regional water supply authorities" to cooperatively manage water supplies. The West Coast Regional Water Supply Authority

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<sup>396</sup> Allman, "The City of the Future: Despite Its Problems, Miami Is the New York and Los Angeles of Tomorrow"; Mohl, "Miami: The Ethnic Cauldron."

<sup>397</sup> US Census Bureau, "Census of Population and Housing."

<sup>398</sup> "Water Boards Draw up Regional System," *St. Petersburg Times*, July 20, 1974, Sam Gibbons Papers, University of South Florida Libraries.

(WCRWSA) was the first intergovernmental agency organized to help solve conflicts in the Tampa Bay area.

The WCRWSA involved five parties: the city of St. Petersburg; Hillsborough, Pinellas, and Pasco counties; and the SWFWMD. It was a “Water Authority” without the legal authority to be a utility or regulator. It was merely a coordinating agency. The WCRWSA could not settle disputes such as which of these parties got water first, and at what rate.<sup>399</sup> The SWFWMD still had the authority to issue pumping and drilling permits for access to groundwater.

Meanwhile, one of the justifications for the reservoirs that had been planned for the Four River Basins Project was to prevent salt water intrusion by keeping a “cap” of fresh water on top of the Floridian aquifer.<sup>400</sup> Now that the reservoirs were unlikely to ever be built, and the severe drought that had started in 1970 showed no signs to abating, the SWFWMD became more aggressive in its efforts to limit pumping from the aquifer to levels it felt were safe to prevent salt water intrusion. The Water Authority wanted to pump more water than its permits from the District allowed. Thus followed decades of litigation.

Dale Twachtman recalled recognizing this dilemma when he later became Secretary of the State of Florida’s Department of Environmental Regulation. “I could see that the water management districts thought that they were in the water supply business, and the cities and counties thought that they were in the water resource business,” he remembered, “and I said, we’d be way better off if we understand who’s supposed to be

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<sup>399</sup> Swihart, *Florida’s Water: A Fragile Resource in a Vulnerable State*.

<sup>400</sup> Tyler, “Florida’s Water: How Long Will We Have Enough?”

doing what....Well, they get it crossed up, but it did help once it got defined, and we put it in the law.”<sup>401</sup>

In 1980, at the request of SWFWMD, the Corps of Engineers completed a water management study on the Four River Basins system. This study highlighted alternative strategies for how excess water could be transported from the less developed outlying areas of SWFWMD to the southern counties with higher demand. For this study, the Corps modelled future water usage in different areas – projecting what areas would have extra water in the future and what areas would have deficits. In the 16-county area there were 2.2 million people in 1975. By 2035 it was projected to reach 5.5 million people (In 2016 it’s about 4.7 million already). Most of the population concentrated in five counties around Tampa.<sup>402</sup>

The city of Tampa had already constructed a water pipeline north to Pasco county to augment municipal water systems from the Hillsborough River and wellfields in Hillsborough County. The Corps of Engineers proposed opening new wellfields in the Floridian aquifer rather than building more pipelines. New reservoir construction, given the struggles of the SWFWMD with this issue in the previous decade, was off the table. Nevertheless, the Corps’ water management study immediately stoked renewed rural fears of water “stealing” – concerns that the water table would be reduced, sinking lakes and killing citrus trees.<sup>403</sup>

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<sup>401</sup> Twachtman, Interview with Dale Twachtman on Water Management, 32.

<sup>402</sup> “Water Becoming a Top Issue,” *Ocala Star-Banner*, January 7, 1980, Box 2, Accession No. 077-98-0046, RG 77, National Archives at Atlanta.

<sup>403</sup> Norm Swetman, “Engineers Reveal Plans to ‘steal’ Area Water,” *Suncoast Sentinel*, October 24, 1980, Box 2, Accession No. 077-98-0046, RG 77, National Archives at Atlanta.

These conflicts set the stage for another intense period of litigation in the 1990s known locally as “the water wars”. It involved jurisdictional conflicts between the WCRWSA, the SWFWMD, and county governments in the Tampa Bay Area. The result is that today Tampa Bay Water, a single institution, is the sole water utility for Tampa, St. Petersburg, and their surrounding counties. It continues to work with the SWFWMD to find alternatives to ground water. With the failure of most of the structural components of the Four River Basins Project, it is an interesting speculation to wonder if natural watershed protection and floodplain management is adequate to the region’s needs. Could the unfinished reservoirs still be built? How much would they cost now?

### **Chapter summary**

Over a 15-year period, from the late 1960s into the early 1980s, flood control projects in Houston, Miami and Tampa saw reassessments, delays, and a few outright cancellations due to grassroots environmental activism and tightening budgets. Each project entered this period under different conditions: In Houston, grassroots organizations were fighting a drainage plan that already had been slowed down by financial headaches for a decade. Activists’ concerted efforts led to the cancellation of the Upper Buffalo Bayou Project and a reassessment of channelization efforts throughout Harris County. In Miami, the water management system had developed considerable institutional “momentum”, and despite national attention focused on saving the remaining Everglades, only peripheral extensions of the C&SF project were truly cancelled by the early 1980s.<sup>404</sup> In Tampa, planning for the Four River Basins Project was still underway

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<sup>404</sup> Hughes, *American Genesis*. Of the three cases I studied, I think Miami has the most in common with the TVA. Although power generation and industrial development were not hallmarks of flood control in South Florida, regional land development was. By 1960, the C&SF District and the Corps

when it became clear that most construction was not going to be supported or funded.

Water management in that region thus became more technically administrative and flood control was pared down to the most essential infrastructure.

Environmental activism in the Southeast was part of a national movement that eventually led to sweeping regulatory reform. Certainly there were cases, such as the Cross-Florida Barge Canal, where grassroots groups succeeded in blocking large projects that might have been completed otherwise. But their impact in Houston, Miami and Tampa was only decisive over very limited components: channelizing a section of Buffalo Bayou, or building a reservoir out of a section of Tampa Bay. The greater legacy of environmental activism in these cities was that the quality of natural resources, and the ecological consequences of growth, would have to be accounted for as the regions continued to develop. In perfect hindsight, this was perhaps also the activists' greatest failure: Their intervention temporarily made the development of Houston, Miami and Tampa less ugly, but regional growth inexorably continued and vulnerability to future storms was exacerbated.

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had developed bureaucratic power over water in South Florida in a way that never happened in Houston, and only later in Tampa.

## **CHAPTER 6**

### **CONCLUSION: COMPARING THE CASES**

#### **What do the three cases have in common?**

All three flood control projects have been highly “successful” – in the sense that they prevented a recurrence of the same floods that motivated the construction of protective works. There have been other floods in each region, but they have not impacted the same areas to the same extent. Downtown Houston has never flooded as it did in 1935. Hialeah and the sugar plantations of the Everglades have never been under a sheet of water for weeks at a time like they were in 1947. And Temple Terrace, home to the University of South Florida, has never seen a repeat of the 1960 floods. Perhaps larger storms caused by climate change will yet overcome the risk thresholds of the projects that were designed to contain an event surpassing the hundred-year flood, but it is more likely the water will go somewhere else; to newly-developed areas where there is no infrastructure in place. Furthermore, the suburban and rural systems in Houston, Miami, and Tampa were not designed to protect low-lying areas near the Gulf and Atlantic from higher tides. That is a different kind of coastal flooding for future systems, such as the one Miami Beach is building today.

The flood control projects in Southeast Texas and South Florida were less successful at anticipating the scale of future development and the unintended consequences caused by that development. Flood control helped stabilize a trajectory of

rapid growth that was already underway in each city. By managing a natural hazard, it helped each city fulfill its destiny as a regional center. But that destiny had the unforeseen effect of making it much harder to complete the flood control projects as originally designed. As suburbs expanded, land values in rural areas increased in all three cities, forcing modifications to earlier plans for large-scale infrastructure. This process unfolded over about 15 years in each city. The most effective, comprehensive, sometimes over-confident, design could not be fully implemented because it became too expensive to acquire rights-of-way.

In Houston, there was no “emergency bypass” of the city, and the two main reservoirs on Buffalo Bayou became the primary flood control system. Of the three sites, the flood control and water storage projects in Miami were the largest and most expensive, but they could have been even more sprawling. The most northern and southern parts of the Central & Southern Florida project were never completed. In Tampa, of course, most of the projects were shelved by the late 1970s. It is ironic that flood control projects gained momentum at critical points in each city’s development, when political will was strong enough to take forward-looking, preventative action to solve the flooding problem, but the region’s subsequent success also made it much more expensive to finish the planned infrastructure.

In other words, there was a feedback between regional development and increasing land values that made it harder to protect each area with structural flood control. Each city has responded differently to this vicious circle. Houston’s unregulated sprawl has meant that the flooding problem recurs again and again, often in the most recently-developed areas on the fringes of the metropolitan area. Miami created a hard



line between wet and dry, filling all the available space between the levee and the coast with single-family homes, and with nowhere else to go, has increasingly turned to building higher density in the urban core. Tampa solved the problem, at least temporarily, by purchasing sensitive lands.<sup>405</sup>

### **What is different about each city in its time?**

Each flood control project was influenced by its own time and place. Houston was modeled on other New Deal-era projects in the South. It was designed before postwar sprawl was even imagined. Houston was a case of an urban flood control system that could not keep up with suburban development despite decades-long struggles to improve drainage. As the city has grown across formerly rural lands, the Harris County Flood Control District has been caught in a cycle of reactionary flood mitigation, only sometimes with federal help. New areas are developed, increasing runoff and putting homes in the path of floods that had not been previously imagined. New regulations, such as requiring the construction of drainage ditches and retention ponds, have not broken the cycle.

In Miami, flood control, ironically, became the greatest constraint on development. This constraint, along with the vast scale of the water management system, makes Miami a truly unique case. Cities along the Southeast coast of Florida are bound by a Central & Southern Florida Project levee to the west, and the ocean to the east. In

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<sup>405</sup> In light of Hurricanes Harvey and Irma (2017), it should be noted that exceptional funding is made available today for disaster recovery, not prevention. That is a big change in the political reality from the mid-20<sup>th</sup> century where the strongest response to shocking floods was to come up with a way of making sure they did not happen again. For many, the impact of the major storms of 2017 will make past infrastructure look inadequate, even if the flooding is occurring in areas that were never supposed to be protected. But will we one day tire of spending tens of billions of dollars on recovery efforts?

the 1950s this division of land and water was a triumph that made a place in the sun available for hundreds of thousands of middle-class families and retirees. It created a regional megacity over a hundred miles long but, at most, 25 miles wide. Today Miami is a city of tall towers, in part because it serves people who are used to living in 50-story buildings in Latin American cities, but also because after 60 years of development, land is limited. Comprehensive flood control in Miami achieved affordable suburbs in the short run but created a densely-populated area that is now more susceptible to flooding from the ocean instead of the Everglades.

Where Miami was a comprehensive success, largely mitigating both flooding and water supply headaches for decades, Tampa's projects solved neither problem. Instead the case of Tampa represented administrative "water management"; it was a story that began with flood control but quickly became mired in water-supply issues. Flood control in the most densely-populated areas of Tampa turned out to be relatively easy to achieve. Supplying an alternative to overly-exploited groundwater resources in the larger Tampa Bay Area turned out to be a persistent challenge, one full of compromises between the needs of farmers, cities, and environmentalists. These compromises were creative, and largely effective in balancing many interests. It is a story that is still playing out, however, because regional development has been so delayed. Large parts of the region of the Four River Basins are still rural today. Some critical lands are protected and groundwater withdrawals are highly regulated. The suburbs of Tampa, St. Petersburg, Clearwater, and Sarasota are all still growing. The solutions water managers reached in the 1980s and 1990s may yet unravel.

## **The Corps and Risk Assessment**

Officials in Houston, Miami and Tampa all campaigned to have infrastructure that would protect core areas from the kind of storm that launched those campaigns. In all three cases, the US Army Corps of Engineers designed infrastructure that was even more robust and extensive than what was needed to protect the cities from those storms. In Florida they also designed systems that would store water in potentially severe drought scenarios. In the cases of Houston and Tampa, the Corps was at times at odds with local authorities who worried about how to finance their share of the project costs. In Houston, the plan for flood protection had to be redesigned multiple times to keep the cost of local contributions down. In Tampa, concerns about costs became intertwined with environmental concerns, and activists, property owners, and even water managers, took action to block the construction of reservoirs and replace them with protected natural areas.

Despite the Corps' insistence on focusing on the high risk events – the 100 plus-year storm, the multi-year drought – and building works that local authorities thought more extensive than necessary, they also underestimated the impacts of suburban growth. The Corps always tried to predict future population growth and land development. In their later projects they conducted formal development forecasting studies in partnership with social scientists, but even those studies did not anticipate the scale of population growth that would occur in the sunbelt into the 1980s. Flood control was supposed to reduce natural hazards and increase confidence in regional development, but the postwar economics that transformed many Sunbelt cities brought persistent, and often unregulated, development to these regions. By the early 1980s, the Flood Control Districts and the Corps of Engineers had become locked in a vicious cycle of having

encouraged development, which then expanded into new areas, and needed to be protected.

By the mid-twentieth century, Corps practice was responding to a larger, data-driven turn in civil engineering.<sup>406</sup> As Army Engineers and local water managers gathered data from past floods, one of the key tasks of the Corps was to model the impact of hypothetical flooding scenarios in order to establish minimum design standards for flood control infrastructure. In the 1950's standardized scenarios such as the "standard project storm", the 100-year flood, and 40-year flood became critical parts of the cost-benefit calculations to justify Corps' projects.<sup>407</sup>

In Houston, the Corps used a project storm, or "design storm", much larger than had impacted the city in 1935.<sup>408</sup> They would have built large, expensive works to contain and divert that water away from the city. Only when local interests pushed back and declared the required state contributions too much of a political challenge to secure did the Corps revise their plans for a more cost-effective, but less protective, solution.

In Miami, design storms based on previous hurricanes were used to plan the height of the levee that would hold back Lake Okeechobee from flooding the farming towns to the immediate south, and the rainfall estimates from the 1947 storm were also

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<sup>406</sup> Martin Reuss, "The Art of Scientific Precision: River Research in the United States Army Corps of Engineers to 1945," *Technology and Culture* 40, no. 2 (1999): 292–323.

<sup>407</sup> Robert L. Wiegel and Thorndike Saville, "History of Coastal Engineering in the USA," in *History and Heritage of Coastal Engineering: A Collection of Papers on the History of Coastal Engineering in Countries Hosting the International Coastal Engineering Conference 1950-1996*, ed. Nicholas C. Kraus (New York: American Society of Civil Engineers, 1996), 513–600.

<sup>408</sup> Harris County, "Transcript of Testimony Taken at the Hearing When the Bypass Plan Was Presented by Colonel Besson to the Navigation and Flood Control Committee."

used to design Water Conservation Areas in the Everglades.<sup>409</sup> This same modeling was used to better understand how much water was being lost to evapotranspiration across the Water Conservation Areas and the wet prairies of the Everglades. But the C&SF Projects were not intended to simply reduce the risk of flooding in areas that were already developed. They were a comprehensive project, meant to completely alter the way water moved in South Florida. It was about transforming natural cycles of drought and inundation across an entire landscape. The C&SF Projects thus created areas that could be developed and areas that could never be developed. With near-total control over the water in the region, there were few storms that the C&SF Flood Control District could envision that would flood the suburbs of Miami and Fort Lauderdale the way they had in 1947.<sup>410</sup>

In Tampa the designs for the Four River Basins were based on modelling the functioning of the reservoir system against the paths and strengths of potential storms.<sup>411</sup> With computer models, there were multiple possibilities to design around instead of just the conditions of the previous major flood. Such modeling allowed the Corps to test different designs for reservoir systems and estimate how much protection they would provide in different storm scenarios. In theory, it also let the Corps compare different regimes for regulating the amount of water flowing through the river basins for purposes other than flood control like water supply, recreation, and protecting natural systems.

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<sup>409</sup> US Congress Committee on Public Works, *Comprehensive Report on Central and Southern Florida*.

<sup>410</sup> Huser, Kirchhoff, and Nicholas, *Into the Fifth Decade: The First Forty Years of the South Florida Water Management District, 1949-1989*.

<sup>411</sup> US Army Corps of Engineers, "Technical Service's Requirements," October 2, 1968, Box 2, Accession No. 077-02-0045, RG 77, National Archives at Atlanta.

By the early 1960s when the Four River Basins project in Tampa was being planned, the Corps' Jacksonville District had become very confident about their experience designing these kinds of water management systems. This was a stark contrast to the open conversations about alternative designs held in Houston between the Galveston District Engineer and a consulting engineer working for Harris County in the 1930s. By the early 1960s, the Jacksonville District Engineer proclaimed that knowledge gained in South Florida over 15 years made the Corps more adept than any consulting engineer that could be hired by local communities to second-guess elements of the project.<sup>412</sup>

### **Flood Control in Houston Today**

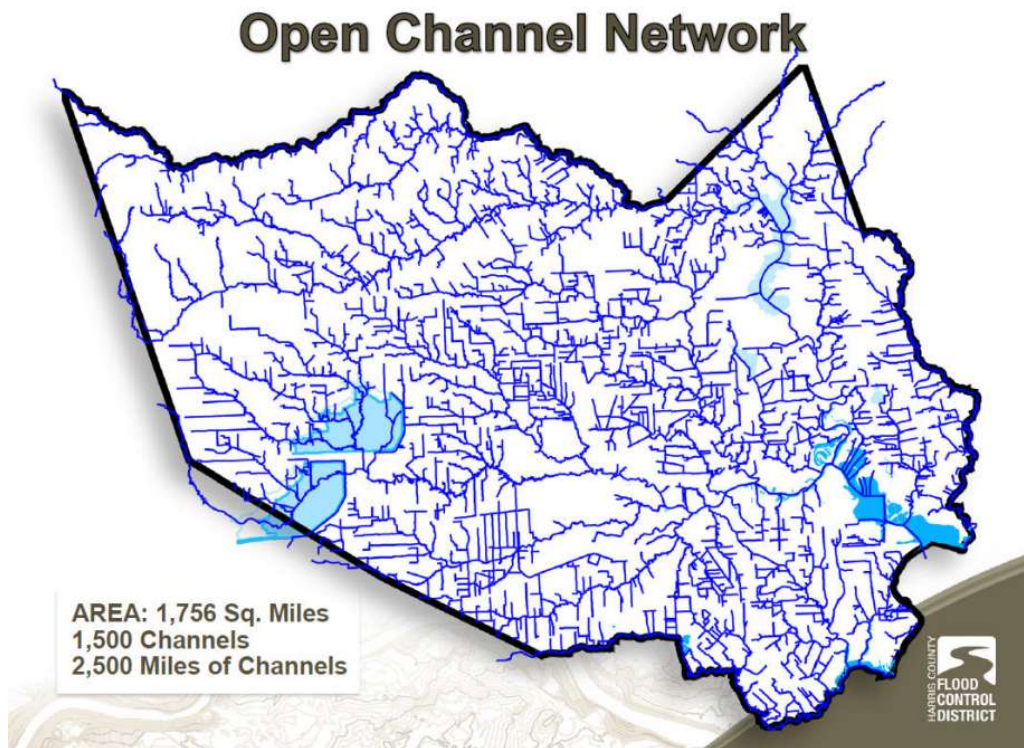
After 70 years Barker and Addicks dams are still the primary flood control for the city of Houston and its suburbs which have encompassed, and then sprawled beyond, the limits of Harris County. The dams need significant repairs and have been categorized as some of the least safe in the country by the Corps of Engineers.<sup>413</sup> A current project expects to spend \$72 million shoring up the earthen and concrete structures that have been cracked and eroded away by decades of intermittent floods. Meanwhile, Harris County monitors an extensive network of drainage channels throughout Metropolitan Houston, nearly all of which have seen flooding in the past three years.<sup>414</sup>

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<sup>412</sup> JV Sollohub, "Letter to Sam Mase, Tampa Tribune," November 21, 1962, Records of the Office of the Chief of Engineers, Jacksonville District, NARA Atlanta.

<sup>413</sup> Lauren Caruba, "Houston Dams Are Old, Beat up and a Vital Line of Defense," *Houston Chronicle*, September 2, 2016, <http://www.houstonchronicle.com/news/houston-texas/houston/article/Houston-dams-are-old-beat-up-and-a-vital-line-of-9199908.php>.

<sup>414</sup> "Hurricane Harvey Is a Seawall Moment for Houston," *Houston Chronicle*, August 31, 2017, <http://www.houstonchronicle.com/opinion/editorials/article/Hurricane-Harvey-is-a-seawall-moment-for-Houston-12165697.php>.



*Figure 6.1 Comprehensive drainage mapping in Harris County. HCFCD, 2016*

In April, 2016, Houston experienced widespread flooding from spring storms. The “Tax Day” storm dropped 17 inches of rain in parts of the city and over 700 homes were flooded.<sup>415</sup> The runoff nearly pushed the Addicks and Barker reservoirs to their absolute holding capacity, and it took nearly two months for the water to drain through controlled discharges into Buffalo Bayou.<sup>416</sup> The 2016 Tax Day storms were an example of the 500-year flood that had repeated again only 15 years after Tropical Storm Allison

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<sup>415</sup> John-Henry Perera, “Revisiting Houston’s Tax Day Floods One Year Later,” *Houston Chronicle*, April 17, 2017, <https://www.chron.com/news/houston-texas/tax-day-flood/article/Revisiting-Houston-s-Tax-Day-Floods-one-year-later-11077890.php>.

<sup>416</sup> Kiah Collier and Neena Satija, “Documents Detail Concerns about Houston Dams — before Harvey,” *The Texas Tribune*, September 28, 2017, <https://www.texastribune.org/2017/09/28/could-houstons-dams-have-failed-during-harvey/>.

caused similarly extensive damage in the area around the Texas Medical Center.<sup>417</sup> In this recent, “unprecedented” case, far flung suburban areas flooded along with areas closer to town where drainage had supposedly been improved. The conclusion was that years of re-development had increased the extent of impermeable surfaces beyond what the capacity of existing drainage system.<sup>418</sup> The Tax Day storm was greater than the “superflood” that Port Director Russell Wait had so easily dismissed in the late 1930s. Although many areas of Houston were flooded, the primary system worked as it was designed to protect most of the downtown and Ship Channel, even without the “emergency bypass” or north and south canals Colonel Besson had designed in 1939.

A year later, hurricane Harvey pushed the limits of the system even further. With an unprecedented 50 inches of rain falling in parts of the Buffalo Bayou watershed, Hurricane Harvey pushed the reservoirs past their capacity and caused spilling around the northern edge of Addicks reservoir, flooding recently-built neighborhoods in the dams’ own floodplains.<sup>419</sup> Downtown and the Ship Channel remained largely dry, but clearly the scale of suburban flooding was beyond anything that had been envisioned in the past.<sup>420</sup>

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<sup>417</sup> Neena Satija et al., “Hell and High Water: Why Isn’t Texas Ready for the Next Big Hurricane?,” *ProPublica/Texas Tribune*, March 3, 2016, <https://projects.propublica.org/houston/>. While data is still being gathered, Hurricane Harvey in 2017 has been called the 1000-year flood.

<sup>418</sup> Baddour, “The Trouble with Living in a Swamp.”

<sup>419</sup> Neena Satija, Kiah Collier, and Al Shaw, “Everyone Knew Houston’s Reservoirs Would Flood — except for the People Who Bought Homes inside Them,” *ProPublica/Texas Tribune*, October 12, 2017, <https://projects.propublica.org/graphics/harvey-reservoirs>.

<sup>420</sup> Please see Appendix B for my personal reaction to the impact of Hurricane Harvey.



Climate change will cause increased flooding in Southeast Texas. Large precipitation events are increasing in frequency over the region.<sup>421</sup> In Houston, there is also growing fear of a “Super Ike” – a major hurricane following close to the path of 2008’s Hurricane Ike.<sup>422</sup> In this scenario, a monster storm passes Galveston Island and heads straight up the Ship Channel. It knocks out refinery production for weeks and sends massive storm surge through chemical plants and the facilities of the Port of Houston. Economic and environmental impacts linger for years. To prevent this nightmare, research into large-scale infrastructure solutions continues, including storm surge gates at the mouth of the Houston Ship Channel.<sup>423</sup>

### **Flood Control in Miami Today**

Whether or not the epic, estimated to surpass \$16 billion, project to restore part of the Everglades ecosystem and ensure continued fresh water quality in South Florida will be effective remains controversial today.<sup>424</sup> But the less-disputed success of flood control in the region has recently encountered unforeseen setbacks as flooding along Miami’s coastline becomes more frequent. Even though most residents in the Miami area live miles from the ocean, tourism at Miami’s beaches has remained a huge part of the region’s economy. The images of the waters of Biscayne Bay and the Atlantic beaches are essential to Miami’s identity. Cycles of beachfront condo development have

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<sup>421</sup> Baddour, “The Trouble with Living in a Swamp.”

<sup>422</sup> Neena Satija et al., “Hell and High Water: Why Isn’t Texas Ready for the Next Big Hurricane?,” *ProPublica/Texas Tribune*, March 3, 2016, <https://projects.propublica.org/houston/>.

<sup>423</sup> Jade Boyd, “Rice Wins \$3.1M to Develop Storm Strategy for Houston-Galveston,” *Rice University News & Media* (blog), March 2014, <http://news.rice.edu/2014/03/11/rice-wins-3-1m-to-develop-storm-strategy-for-houston-galveston/>.

<sup>424</sup> Jenny Staletovich, “Cost of Everglades Restoration Could Double to \$16 Billion,” *Miami Herald*, March 30, 2016, <http://www.miamiherald.com/news/local/environment/article69122437.html>.

continued for decades, with ever taller towers and more luxurious apartments. Now these coastal areas are experiencing more frequent flooding due to climate-change driven increases in sea level.<sup>425</sup> The city of Miami Beach is currently spending \$400 million on systems of embankments, culverts, and pumping stations to keep the barrier island dry.<sup>426</sup>

The Central and Southern Florida Project was designed in 1949 to control surface flooding that originated in the Everglades. Flooding came from the land, not the sea. While at the time there was little concern for coastal tides or hurricane storm surge, salt-water intrusion into the aquifers that supplied fresh water was a constant headache for water managers. Atlantic hurricanes that made landfall in the Miami area much later in the postwar era, such as Hurricane Andrew in 1992, caused extensive wind damage, but they astoundingly did not bring flooding to Miami or its beaches.<sup>427</sup> Occasionally a very high seasonal tide combined with a cloudburst could flood streets on Miami Beach, but these events were not frequent enough to start a process towards constructing major infrastructure to protect the coast.

In the late 1960s, Miami's beach was rebuilt by the Corps of Engineers after years of erosion and hotel over-development.<sup>428</sup> This project was justified based on the Corps' expanded cost-benefit calculations to value recreational benefits of the coast. Miami

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<sup>425</sup> Miami-Dade Sea Level Rise Task Force, "2014 Report and Recommendations," 2014, <http://www.miamidade.gov/planning/library/reports/sea-level-rise-report-recommendations.pdf>.

<sup>426</sup> Jessica Weiss, "Miami Beach's \$400 Million Sea-Level Rise Plan Is Unprecedented, but Not Everyone Is Sold," Miami New Times, April 19, 2016, <http://www.miaminewtimes.com/news/miami-beachs-400-million-sea-level-rise-plan-is-unprecedented-but-not-everyone-is-sold-8398989>.

<sup>427</sup> Jay Barnes, *Florida's Hurricane History*, 2nd ed (Chapel Hill: University of North Carolina Press, 2007).

<sup>428</sup> Theodore M. Hillyer, "The Corps of Engineers and Shore Protection: History, Projects, Costs," National Shoreline Management Study (US Army Corps of Engineers Institute for Water Resources, May 2003), [http://www.nationalshorelinemanagement.us/docs/National\\_Shoreline\\_Study\\_IWR03-NSMS-1.pdf](http://www.nationalshorelinemanagement.us/docs/National_Shoreline_Study_IWR03-NSMS-1.pdf).

Beach was still a key symbol of postwar Florida. Environmental Historian Ted Steinberg notes that even this massive project was not designed to protect Miami Beach from the kind of storm surge that damaged the city in the 1926 hurricane. Rather, the model of the 70-year storm was used for beach slope elevations and dune cover.<sup>429</sup>

Starting in the early 2000's, however, Miami Beach and suburbs close to Biscayne Bay began to flood more frequently. Global average sea levels rose almost a foot during the twentieth century, and the relative impact of that increase was more dramatic in some areas rather than others due to development, local tidal patterns, and the slope of the sea floor.<sup>430</sup> Miami Beach has now taken serious steps to prepare for these impacts of climate change, even during a period when Florida politics still borders on denial of the threat to the state.<sup>431</sup> Today the city of Miami Beach is spending almost \$500 million to raise waterfront streets and install pumping systems to mitigate flooding from higher tides.<sup>432</sup>

### **The future: adapting to the impacts of climate change**

Today climate change is causing oceans around the world to rise. Flooding from higher tides and tropical storms increasingly threaten major coastal cities like Houston, Miami and Tampa. In the twentieth century flood control helped these cities successfully develop on low-lying coastal plains. It created space for the low density suburban growth

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<sup>429</sup> Steinberg, *Acts of God the Unnatural History of Natural Disaster in America*.

<sup>430</sup> Benjamin H Strauss et al., "Tidally Adjusted Estimates of Topographic Vulnerability to Sea Level Rise and Flooding for the Contiguous United States," *Environmental Research Letters* 7, no. 1 (March 1, 2012): 014033, <https://doi.org/10.1088/1748-9326/7/1/014033>.

<sup>431</sup> Joey Flechas and Jenny Staletovich, "Miami Beach's Battle to Stem Rising Tides," *Miami Herald*, October 23, 2015, <http://www.miamiherald.com/news/local/community/miami-dade/miami-beach/article41141856.html>.

<sup>432</sup> Flechas and Staletovich.

that was a defining feature of the mid-century sunbelt. The Atlantic Ocean and the Gulf of Mexico were a more distant threat than floods pouring down the bayous, Everglades wetlands, and Hillsborough River.

In the future, however, flooding may increasingly be a threat from both local watersheds and the coastline. Because of their particular geography, Houston, Miami and Tampa are vulnerable to pincer-like inundation from nearby rivers, the Everglades, the Gulf of Mexico, and the Atlantic Ocean. As the impacts of climate change become more pronounced, each city faces the “bowl” scenario that has long been the unsolvable problem for New Orleans. Adapting to these conditions will be the work of coastal engineers and flood control specialists in the future.

Historical case study analysis is a powerful tool for identifying factors that are often overlooked in a current policy debate.<sup>433</sup> It also helps reveal assumptions that may be restricting a fuller discussion of the issue. The most glaring, widely-held public assumption about adaptation to climate change in the Southeastern United States is that the challenge of flooding in low-lying, coastal areas is new. This dissertation has endeavored to show that flooding was a common and persistent challenge in major cities on the Gulf and Southern Atlantic coasts since the mid-1930s. In fact, Metropolitan development in these regions was fundamentally not adapted to the scale of local hazards because those hazards had been extensively mitigated by decades of federal investment. Flood control systems had become largely invisible through their own success, until recently. The vulnerability of these cities to the impacts of climate change, and the public

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<sup>433</sup> Richard F. Hirsh, “Historians of Technology in the Real World: Reflections on the Pursuit of Policy-Oriented History,” *Technology and Culture* 52, no. 1 (2011): 6–20, <https://doi.org/10.1353/tech.2011.0039>.

decisions that must be made to protect some areas over others, demands a greater awareness of how these decisions were made in the past.

As recurrent flooding concerns have returned to Houston, Miami, and Tampa, local media has served these communities well by recovering the history of flood control projects.<sup>434</sup> Of the three cities, Tampa has been the most lucky when it comes to severe storms.<sup>435</sup> But, as in Houston, there exists a nightmare scenario in Tampa – a repeat of The Great Gale of 1848 that pushed an estimated 15-25 foot wall of water over much of the area that is the most densely populated today. Climate change only increases the likelihood of this rare, worst-case disaster, and there are few defenses against it.<sup>436</sup>

A critical perspective would argue that local officials, chamber of commerce, newspapers, and state representatives were so focused on securing the potential of their cities that they insisted on plans that modified natural systems to permanently allow forms of settlement that should not have been there in the first place. Surely the developers were the greatest beneficiaries of this reduction of natural hazards. From that perspective, the Corps of Engineers, as the nation's contractor tasked with designing and manifesting this transformation, was arrogant in trying to engineer landscapes that could accommodate development that was poorly adapted to the original conditions. Even worse, flood control projects created a feedback loop between denial of the risks, rapid development, and the need to protect newly-developed areas from flooding. Given the

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<sup>434</sup> Baddour, "The Trouble with Living in a Swamp."

<sup>435</sup> Tampa continued to be lucky in 2017, narrowly dodging a bullet in the form of Hurricane Irma.

<sup>436</sup> Brian McClure, "The Tampa Bay Area Has Been Lucky," *Tampa Bay Times*, May 21, 2010, <http://www.tampabay.com/news/weather/hurricanes/the-tampa-bay-area-has-been-lucky/1096585>.

increasing risks associated with climate change, these choices seem particularly short-sighted in retrospect.

A less critical, and I believe better historically-situated, perspective, however, frames flood control as a purposeful choice, one that allowed these coastal towns to become major cities in their regions, and those regions to develop national significance. Local boosters worked through state representatives and Congress to direct the Corps to implement infrastructure that helped these cities grow beyond their geographic limitations, in a style that reflected the postwar suburban pattern of the nation as a whole. The success of these cities, as economic drivers in their regions, justified the financial investment.

The questions of whether or not this was the optimal way to develop a low-lying area, or if flood control created a false confidence in the stability of these vulnerable sites, are important, but they cannot be answered here. Instead, we must start by recognizing the reality of heavily developed, coastal cities that now must be further protected because millions of people live there and they are important to the country. Instead let us ask: If we were willing to make significant, repeated investments on infrastructure to protect growing cities in vulnerable areas in the past, should we not consider making the same decisions in the future as we adapt to climate change?

## **EPILOGUE: A PERSONAL RESPONSE TO HURRICANE HARVEY (2017)**

I wrote this personal response soon after Hurricane Harvey caused catastrophic flooding in Houston in late August, 2017. Through the archives, I had relived many of the city's most devastating floods, and I knew well that Harvey's nearly 50 inches of rain were completely unprecedented in Southeast Texas. I feared for friends and family in Houston. I couldn't sleep. This dissertation is about the past, and I know historians are famously bad at predicting the future, but it was traumatic to watch one of the worst-case scenarios for Houston playing out in front of me. Predicting the future was no longer a throw-away phrase about "stronger storms one day impacting coastal areas" – it was praying for the rain to stop, now. I wanted to say something about climate change, before we even knew the role of climate change in the storm, and I wanted to say something about the history I had studied that might address the powerlessness I felt.

### **Houston's original flood control system was never completed. Could that have prevented this disaster?**

Downtown Houston was underwater. Over the last three days more than 20 inches of rain had fallen in Harris County, and Buffalo Bayou had risen 45 feet. As the sluggish bayou transformed into a swollen river, lives were lost, and damage to the city was widespread. People drowned as flash flooding tore them from downtown bridges. Warehouses and commercial buildings near Buffalo Bayou were completely destroyed, and over 100 residential blocks were flooded. Fires broke out in some of the damaged buildings. The Port of Houston was closed entirely for ten days, and the US Army Corps

of Engineers spent the next eight months clearing silt, mud, and debris from the Ship Channel. Calls to prevent a similar catastrophe from occurring again came as swiftly as the rushing currents.



Figure 0.1 Newspaper clipping from the 1935 flood. Bob Eckles Scrapbooks, Harris County Archives

This may sound familiar. But I'm not talking about the history-making rainfall that caused devastating flooding in Houston over the past week. I'm referring to another historic moment in the Bayou City: the flood of 1935 — an event I've explored in my dissertation research, which compares the history of flood control in Houston, Miami, and Tampa.<sup>437</sup> There have been several articles covering that historic flood that hit

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<sup>437</sup> Katherine Arcement, "Houston's Besieged Dams Were Built 70 Years Ago after This 1935 Flood Devastated the City," *Washington Post*, August 30, 2017, sec. Retropolis, <https://www.washingtonpost.com/news/retropolis/wp/2017/08/30/houstons-besieged-dams-compromised-by-harvey-rainfall-were-built-70-years-ago-after-devastating-floods/>.



Houston and the federally-sponsored efforts to prevent recurrences of it that followed.<sup>438</sup>

But there's a key detail that hasn't been emphasized enough: Houston's original flood-control system was never finished.

From my historical research, I want to first explain why I think the original plans for flood control in Houston were not finished and then speculate on how well it would have protected the city if it had been fully in place.

After the flood of 1935, the Master Project Plan for Houston's flood control system, designed and built by the US Army Corps of Engineers, included two large dams, two long canals, and several other smaller structures.<sup>439</sup> By 1948, the two dams were built in rural land between the fairly compact city of Houston and the nearby country town of Katy.<sup>440</sup> At that time, the dams cost around \$11 million, and about \$3 million of that total was paid by Harris County.<sup>441</sup> During the days of relentless rain produced Hurricane Harvey, those two dams, Barker and Addicks, functioned as they were designed to do: their pools filled to hold back Harvey's floodwaters (although there was leakage around

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<sup>438</sup> Gonzales, "Houston's Devastating Flood of 1935"; Dan Grossman and Alex Maclean, "Lessons from Hurricane Harvey," Pulitzer Center on Crisis Reporting, March 15, 2018, <https://pulitzercenter.org/reporting/lessons-hurricane-harvey>; Tim Wallace, "How One Houston Suburb Ended Up in a Reservoir," *The New York Times*, March 22, 2018, sec. U.S., <https://www.nytimes.com/interactive/2018/03/22/ushttps://www.nytimes.com/interactive/2018/03/22/us/houston-harvey-flooding-reservoir.html>; Zaveri, "Officials Patched and Prayed While Pressure Built on Houston's Dams"; Satija, Collier, and Shaw, "Everyone Knew Houston's Reservoirs Would Flood — except for the People Who Bought Homes inside Them."

<sup>439</sup> Lauren Caruba and Michael Ciaglo, "Dams in Distress," Houston Chronicle: Readymag, 2017, <https://readymag.com/581039/>. See the Corps' 1940 Master Project Plan for Buffalo Bayou and Tributaries here: <https://www.documentcloud.org/documents/4328786-Buffalo-Bayou-and-Tributaries-Original-Plan.html>

<sup>440</sup> Colonel Richard Pannell, "United States Army Corps of Engineers Addicks and Barker Dam Safety Overview," October 29, 2014, <http://www.swg.usace.army.mil/Portals/26/102914%20AB%20presentation.pdf>.

<sup>441</sup> Pick to Secretary of the Army, "Letter Approving Modifications to Buffalo Bayou and Tributaries Project."

the edges as they went beyond their designed capacity).<sup>442</sup> Some of the flanking overflow was safely let out into Buffalo Bayou, but neighborhoods nearby did experience extensive flooding.<sup>443</sup> So far, however, the dams have worked to prevent the most serious flooding downtown. All the city's other bayous faced unprecedented flooding, inundating surrounding neighborhoods.<sup>444</sup>

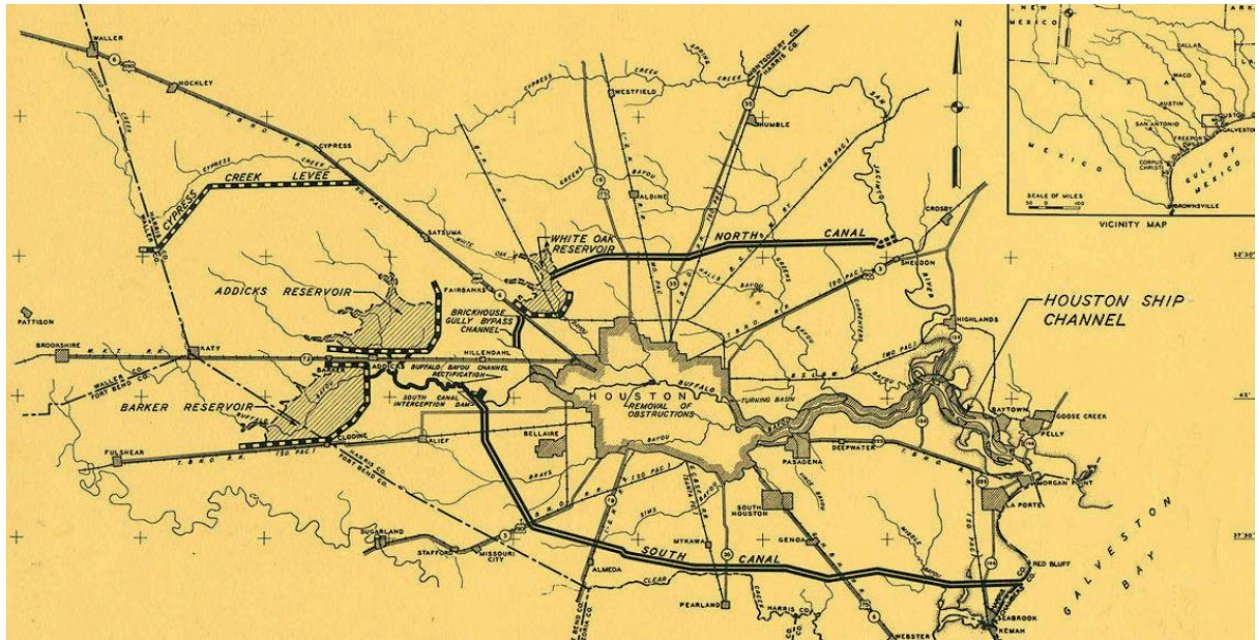


Figure 0.2 Master Plan for the Buffalo Bayou Project, 1940. Harris County Flood Control District, Harris County Archives.

Some of those same neighborhoods in Southwest Houston also experienced repeated flooding in the late 1940s and 1950s soon after many of those suburban areas

<sup>442</sup> Emily Wax-Thibodeaux, Alex Horton, and Amy B. Wang, "Houston Dam Spills over for the First Time in History, Overwhelmed by Harvey Rainfall," *Washington Post*, August 29, 2017, sec. Post Nation, <https://www.washingtonpost.com/news/post-nation/wp/2017/08/28/houston-releases-water-from-two-dams-in-attempt-to-prevent-uncontrolled-overflow/>.

<sup>443</sup> Katharine Shilcutt and Roxanna Asgarian, "The Deliberate Flooding of West Houston," *Houstonia*, October 16, 2017, <https://www.houstoniamag.com/articles/2017/10/16/barker-addicks-reservoirs-release-west-houston-memorial-energy-corridor-hurricane-harvey>.

<sup>444</sup> Al Shaw et al., "How Harvey Hurt Houston, in 10 Maps," *ProPublica/Texas Tribune*, January 3, 2018, <https://projects.propublica.org/graphics/harvey-maps>.

were first developed.<sup>445</sup> The south canal was planned as an outlet to Galveston Bay for floodwaters on Buffalo Bayou, and the north canal would shunt floods on White Oak Bayou to the San Jacinto River. But critically, the canals would also have provided some relief for floods on Brays, Sims, Greens, and Halls Bayous.

When the canals were planned in 1940, the land through which they would flow, such as the Northside area and the current route of Beltway 8 on the south side, was mostly rural prairie. It was relatively cheap land to acquire. But after World War II, that land became much more expensive as developers looked to build affordable housing for young families moving to the Houston area.<sup>446</sup> For example, the population of close-in suburban areas such as the town of Bellaire and the neighborhoods of South Houston, both near to Brays Bayou, doubled between 1940 and 1950.

During the war, the importance of key defense industries located along the Houston Ship Channel had been used as a justification to expedite the completion of the two dams protecting Buffalo Bayou and the Port of Houston. The wartime necessity of the port was key to getting large parts of a civil works project completed when many other military projects vied for scarce resources. With Barker Dam in place in 1945 (and Addicks in 1948), the primary goal of the Buffalo Bayou Project was complete.

But after the war, as the country stumbled into a sharp recession in late 1945, completing the original plan for the Buffalo Bayou Project that would have better protected the city's growing suburbs was less of a priority. The cost of completing the canals rose dramatically as land values increased. As the suburbs grew, and land values

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<sup>445</sup> Whisenhunt, "More Rain Forecast; Flood Damages Thousands of Homes."

<sup>446</sup> "Harris County's Boom Growth Costs Money."

continued to rise, flood control became more prohibitively expensive, and this cycle continued to exacerbate the newly-developed areas' vulnerability.

Because suburban flooding was so persistent, in 1949 the Corps began a resurvey of the project they had just (partially) completed.<sup>447</sup> It was clear that new neighborhoods needed to be protected, but the high costs were harder to justify since the city's key infrastructure was not in the suburban areas. A new plan began to emerge. Instead of the expensive canals, perhaps floodwaters could just be channeled more quickly through the city. For example, Brays Bayou, which had repeatedly flooded neighborhoods like West University Place, the Texas Medical Center, and Bellaire would need to be cleared of brush, deepened, straightened, and eventually lined with concrete. The Flood Control Act of 1954 authorized these modifications to Houston's flood control system so that more of the city's bayous could be "rectified."

As late as 1956, however, business and civic leaders involved in a committee on flood control organized by the Houston Chamber of Commerce still held out hope that one of the north and south canals could somehow be built.<sup>448</sup> At the committee's monthly meeting in April that year, Kenneth Heagy, the Chief Engineer of the Corps' Galveston District, had to remind attendees that both canals in the original 1940 Flood Control Master Project Plan had to be abandoned due to rapid development in the Houston area. The remaining option was to improve existing drainage through the city, and Harris

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<sup>447</sup> Pick to Secretary of the Army, "Letter Approving Modifications to Buffalo Bayou and Tributaries Project."

<sup>448</sup> Houston Chamber of Commerce, "Minutes of the Flood Control Committee," May 14, 1956.

County would still need to come up with nearly half the money (almost \$20 million in 1956).

The difficulty with raising money through county bonds was the other big problem with local flood control efforts in the 1950s. Voters' reluctance to approve any new debt that would potentially raise taxes made it hard for the Harris County Flood Control District to meet its obligations to contribute to the federal projects. In the early 1950s, voters easily approved bonds that would pay for expanded county roads, flood control, and improvements to the Port of Houston.<sup>449</sup> But by 1956, it took repeated elections, and aggressive campaigning on behalf of the county, business leaders, and newspapers to get those bonds approved.<sup>450</sup> Raising money this way was a challenge not only in Houston but also in rapidly-sprawling cities across the sunbelt, as suburban residents became more distrustful of local government projects and services.

Over the next few decades, federal and local officials expanded and significantly improved Harris County's drainage system. In the 1970s, there was some shift away from the idea of concrete-lined waterways towards the concept of preserving land for natural (also called non-structural) flood control. Today flood-control projects in Houston, such as \$480 million Project Brays, which includes channel widening and detention basins, are still on-going.<sup>451</sup> But in general terms, the system is the same as the one that was

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<sup>449</sup> "County Bond Issue Would Augment U.S. Flood Plans."

<sup>450</sup> "County Bond Issues Will Build Freeways and Control Floods."

<sup>451</sup> Mike Morris, "Brays Bayou Project Propelled with \$47 Million Loan from State Water Agency," *Houston Chronicle*, October 18, 2017, <https://www.houstonchronicle.com/news/politics/houston/article/State-water-board-OKs-47M-loan-to-speed-up-Brays-12285667.php>; "Project Brays," Harris County Flood Control District, 2015, <https://www.hcfcd.org/projects-studies/brays-bayou/project-brays/>.

envisioned in the Flood Control Act of 1954.<sup>452</sup> There are two major dams and no canals. Floods drain via a complicated network of waterways through the city and out into Galveston Bay. A storm like Harvey utterly overwhelms this system.<sup>453</sup>

While it is still early days to make sweeping statements, I think it is unlikely that even if the original Master Project Plan had been completed the system could have dealt with the unbelievable amount of water unleashed by Harvey. Flood control systems are designed to handle a certain amount of water passing through them at a certain rate. In order to design a system with enough capacity to contain a major flood, engineers build a model of a hypothetical storm and calculate how much rain it will produce, how quickly that rain will fall, and where it will fall. Often a scenario even more extreme than the worst storm to hit an area in the past is used to create the model storm.

In both the 1930s and 1950s, during both design phases of the Buffalo Bayou Project, there were disagreements between consulting engineers, local officials, and the Corps of Engineers over just how bad a storm could hit the Houston area.<sup>454</sup> Often the Corps was pushing to design a more robust system with greater capacity, based on a larger “project storm” than Harris County officials wanted to ask voters to pay for. In county and university archives, I saw a lot of different scenarios from those decades, from both the Corps and local flood control engineers, but none of them came anywhere close to anticipating the 50 inches of rain from a single storm that Harvey produced (a

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<sup>452</sup> General Samuel D.. Sturgis Jr., “Annual Report of the Chief of Engineers, U.S. Army, on Civil Works Activities,” *Report of the Chief of Engineers, U.S. Army, on Civil Works Activities.*, 1954, [//catalog.hathitrust.org/Record/010054844](https://catalog.hathitrust.org/Record/010054844).

<sup>453</sup> “Hurricane Harvey Is a Seawall Moment for Houston.”

<sup>454</sup> Wait, “Letter to RJ Cummins,” July 19, 1938.

26-inch peak was discussed as the upper limit in 1956).<sup>455</sup> Canals or no canals, there was no design for a Harvey.

But for a moment let's imagine history playing out differently. Let's imagine a city that might have better weathered the most extreme rain event in the history of the continental US.<sup>456</sup>

*By 1950, Houston's flood control system was complete. There were two dams on Buffalo Bayou and one on White Oak Bayou. A levee along Cypress Creek prevented floods flowing south into the city. A northern canal helped divert water away from Greens Bayou. In the south, Brays Bayou had another outlet to a canal.*

*Land around the canals remained rural and provided some natural areas for flooding overflow. In a stunning break with the policies of other sunbelt cities (with the exception of Tulsa, OK<sup>457</sup>), Harris County authorities strictly limited development to well outside of the 100-year floodplain. Neighborhoods were narrowly constrained on the high ground between the bayous. Because demand for housing was high and land outside of the floodplains was scarce, suburban property was even more expensive than expected. Houston's neighborhoods ended up being dense — mostly townhomes and apartments — and they made more sense to serve with public transit. New developments had to provide for extensive drainage. Freeways were fewer, and those that were built were greatly elevated above flood zones. Over several decades, the city became much better adapted to its location on the coastal plain, its poorly-draining, sandy soils, and*

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<sup>455</sup> Houston Chamber of Commerce, "Minutes of the Flood Control Committee," May 14, 1956.

<sup>456</sup> Jason Samenow, "60 Inches of Rain Fell from Hurricane Harvey in Texas, Shattering U.S. Storm Record," *Washington Post*, September 22, 2017, sec. Capital Weather Gang, <https://www.washingtonpost.com/news/capital-weather-gang/wp/2017/08/29/harvey-marks-the-most-extreme-rain-event-in-u-s-history/>.

<sup>457</sup> Joe Wertz, "How Tulsa Became A Model For Preventing Floods," KOSU.org, November 20, 2017, <http://kosu.org/post/how-tulsa-became-model-preventing-floods>.

*its extreme rain events.*

Even in this alternative Houston, it's likely that a record-shattering storm like Harvey would still have flooded the city, but I suspect the damage would have been far less extensive. More importantly, we can imagine this counterfactual city and acknowledge that it may not have been Houston's past, but perhaps, it is one vision for its future.



## **APPENDIX A: A SHORT HISTORY OF COASTAL ENGINEERING**

This appendix briefly lays out a sketch of the history of coastal engineering in parallel with the cases of flood control I discussed in earlier chapters. My primary research focused on flood control infrastructure in low-lying areas of the US Southeast coast. Similar kinds of levees, canals, dams and pumps for water management were built in other parts of the United States - in places such as Phoenix, for example - but Houston, Miami, and Tampa had a common geography as cities of the coastal plain. While the US Army Corps of Engineers designed works for flood control they were simultaneously engaged in projects along the shoreline and in nearshore waters that clearly affected the development of Southeast Texas and South Florida.

My challenge in combining coastal engineering with inland flood control is that the sample of records I reviewed separate the authorization and execution of coastal projects, on beaches and in waterways, from flood control projects in the watersheds around cities. But almost certainly some of the same staff did work on projects in both locations. For example, engineers who designed drainage systems also planned dredging programs to deepen channels. And in the postwar decades, local Representatives desperately asked Congressional appropriations committees to fund harbor deepening in the same statements where they tried to see flood control projects completed. Thus the work, and the sponsorship of that work, did overlap. The practice of coastal engineering

and inland flood control underwent similar changes in approach over the decades: from structures meant to transform unstable, natural environments to administrative actions meant to prioritize the functioning of local ecosystems.

As a mid-twentieth-century discipline, coastal engineering came to study, model, and eventually analyze shoreline processes. Better understanding of waves, erosion, and storms allowed coastal engineers to design more appropriate and successful structures for America's coastlines. That knowledge also steered the community of practitioners away from structural interventions and towards preservation of natural features.

## **Introduction**

American engineers have been studying shoreline erosion processes and building significant coastal structures since the late 19<sup>th</sup> century.<sup>458</sup> The advancement of the discipline of coastal engineering largely coincides with a sustained interest in coastal development in the twentieth century. The desire to vacation and live near the seashore drove the development of coastlines from New Jersey in the early twentieth century to California and Florida after World War Two. People also wanted to get out on the water, for sport fishing and recreational boating, and the number of marinas and harbors grew along with beachfront development. On average, the population of shoreline counties in the United States grew rapidly after the War, and these areas became increasingly densely populated compared to inland counties.<sup>459</sup> In the postwar decades, offshore oil drilling

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<sup>458</sup> Wiegel and Saville, "History of Coastal Engineering in the USA."

<sup>459</sup> NOAA, "National Coastal Population Report: Population Trends from 1970 to 2020," NOAA's State of the Coast (National Oceanic and Atmospheric Administration, March 2013), <http://oceanservice.noaa.gov/facts/coastal-population-report.pdf>. Over a forty year period from 1970 to 2010, the population of "shoreline counties" increased by about 35 million persons to a total of 123 million (39% of the US total). Population density of those counties increased to 446 persons/square mile, more than 4 times greater than the US average.

became another key problem domain for the newly-recognized sub-discipline of “coastal engineering”.<sup>460</sup> The first conference dedicated to sharing lessons learned among the distinctive coastal engineering community of researchers and practitioners was organized in 1950 at Long Beach, California, a crossroads of shoreline and oil development.<sup>461</sup>

### **Federal involvement in flood control and shoreline protection**

In the early 19<sup>th</sup> century the US Army Corps of Engineers was first in charge of building fortifications for key harbors, mapping access routes to the West, building canals, and clearing navigation channels.<sup>462</sup> After the Civil War, the Corps and local authorities started working on flood control projects on the Mississippi River. Under the Mississippi River Commission, the Corps built levees and stabilized eroding banks with concrete revetments. Despite decades of levee construction, devastating flooding inundated communities on the Arkansas, Red, and lower Mississippi Rivers in April, 1927. The next year Congress passed the Flood Control Act of 1928 authorizing a massive project on the Mississippi River and Tributaries.<sup>463</sup> The Corps took charge of the project, and over the next several decades added control structures that could be opened

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<sup>460</sup> BP Deep Horizon Oil Spill Commission, “A Brief History of Offshore Oil Drilling,” Staff Working Paper 1 (National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling), accessed February 26, 2017, <http://web.cs.ucdavis.edu/~rogaway/classes/188/materials/bp.pdf>. In 1954, the year the federal government started leasing drilling sites on the outer continental shelf, offshore oil production was 133,000 barrels a day. By 1971 offshore production had grown to 1.7 million barrels a day.

<sup>461</sup> J. W. Johnson, ed., *Coastal Engineering 1950: Proceedings of the First Conference, Long Beach, California* (Berkeley, CA: The Engineering Foundation, Council on Wave Research, 1951).

<sup>462</sup> *The U.S. Army Corps of Engineers: A History* (Office of History, US Army Corps of Engineers, 2007), 57, [http://www.publications.usace.army.mil/Portals/76/Publications/EngineerPamphlets/EP\\_870-1-68.pdf?ver=2013-08-22-092816-420](http://www.publications.usace.army.mil/Portals/76/Publications/EngineerPamphlets/EP_870-1-68.pdf?ver=2013-08-22-092816-420).

<sup>463</sup> Mississippi River Commission, “The Mississippi River and Tributaries Project: Floodways Information Paper,” 3.

at critical moments to divert floodwaters into alternate channels, such as the Atchafalaya floodway in Louisiana.<sup>464</sup>

Structural flood control on the nation's coastlines was on a smaller scale. A large seawall built to protect the island resort and critical port of Galveston, Texas, after catastrophic damage and loss of life from the Great Hurricane of 1900, was a notable exception.<sup>465</sup> In the late 19<sup>th</sup> century, railroads began connecting seaside resorts like Ocean City and Atlantic City to densely crowded, and increasingly polluted, urban centers like Philadelphia. A health-restoring weekend by the sea became accessible to an emerging middle class, who also had money to spend on entertainment.<sup>466</sup> In the early twentieth century, public beaches and boardwalks such as New York's Coney Island, only a subway ride away from the heart of the city, made the coastline accessible for much larger populations. Early municipal projects to prevent beach erosion focused on some of the most heavily utilized vacation areas along the Long Island and New Jersey shorelines.<sup>467</sup> By the 1920s, the beaches of these new, barrier-island resorts had become thickets of stone structures - groins, jetties, and retaining walls - designed to prevent sand erosion. They were largely unsuccessful.

The movement of sand – or littoral transport by longshore drift – was a process that was poorly understood at the time. Sand travelling down the coast was trapped on the

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<sup>464</sup> John McPhee, *The Control of Nature* (New York: Farrar, Straus, Giroux, 1989).

<sup>465</sup> Davis, "History of the Galveston Sea Wall."

<sup>466</sup> Charles E. Funnell, *By the Beautiful Sea: The Rise and High Times of That Great American Resort Atlantic City*, 1st ed (New York: Knopf, 1975).

<sup>467</sup> Wiegel and Saville, "History of Coastal Engineering in the USA"; Richard B. Dornhelm, "The Coney Island Public Beach and Boardwalk Improvement of 1923" (American Society of Civil Engineers, 2003), 52–63, [https://doi.org/10.1061/40682\(2003\)6](https://doi.org/10.1061/40682(2003)6).

“upcoast” side of the jetty, while waves scoured ever more deeply into the downcoast beach. Property owners further down the beach were forced to construct their own jetties. Overall these structures did little to slow these forces that inevitably destroy and re-form barrier islands, but they gave some illusion of permanence in rapidly-developing vacation areas. The Army Corps of Engineers’ Beach Erosion Board (BEB) was organized in 1930 to sponsor research on erosion, the movement of coastal sediments, and the impacts of storms on barrier islands.<sup>468</sup>

One example of a research project sponsored by the Beach Erosion Board was Morrough O’Brien’s investigation of the unintended consequences of a breakwater at Santa Barbara, California in the early 1930s. O’Brien was a young mechanical engineering professor at UC Berkeley who had studied at MIT and then completed a fellowship in fluid mechanics in Germany and Sweden.<sup>469</sup> He had also been one of the first researchers to investigate littoral drift, both in New Jersey and California, for the Corps of Engineers. According to O’Brien, who had no prior experience with shoreline projects, it was the first “systematic study” of coastal phenomena in the United States.<sup>470</sup> O’Brien’s observations first helped establish the principle that in California sand generally moved southward, like a river close to the coastline, parallel to the shore.<sup>471</sup>

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<sup>468</sup> Mary Louise Quinn, “The History of the Beach Erosion Board, U.S. Army, Corps of Engineers, 1930-63” (Coastal Engineering Research Center, 1977), <http://cdm16021.contentdm.oclc.org/cdm/ref/collection/p16021coll4/id/37>.

<sup>469</sup> Richard G Folsom and Robert L. Wiegel, “Morrough Parker O’Brien,” in *Memorial Tributes: National Academy of Engineering*, vol. 4 (National Academies Press, 1991), <https://www.nap.edu/read/1760/chapter/46>.

<sup>470</sup> Morrough P. O’Brien, Morrough P. O’Brien: Dean of the College of Engineering, Pioneer in Coastal Engineering, and Consultant to General Electric, interview by Marilyn Ziebrath, 1988, Regional Oral History Office, Bancroft Library, UC Berkeley.

<sup>471</sup> Quinn, “The History of the Beach Erosion Board, U.S. Army, Corps of Engineers, 1930-63.”

At Santa Barbara, a new breakwater had been constructed in 1929 by the city to create an artificial harbor for small craft.<sup>472</sup> Soon unforeseen erosion led to the destruction of ten miles of downcoast beaches. Several beachfront homes south of Santa Barbara slipped into the ocean as erosion intensified. The town began to lose the municipal beach at the base of its popular pier. Meanwhile, a large, new beach formed upcoast of the breakwater, and after a few years the new small craft harbor rapidly filled with sand and required extensive dredging to remain accessible.

By 1930, O'Brien had taken over the Hydraulics Laboratory and Pump Testing facilities at UC Berkeley, and in their experimental tank he proceeded to build a model of Santa Barbara harbor to see if he could re-create the siltation problem. Several engineers who later worked for the Corps' Los Angeles District remembered getting their initial training in coastal processes through O'Brien's lab and his experiments on solving the Santa Barbara problem in the mid-1930s.<sup>473</sup> O'Brien's research led to the first sand-bypassing plant at Santa Barbara, which restored sand nourishment to the downcoast beaches and reduced how often the harbor needed to be dredged.<sup>474</sup> As a technique for

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<sup>472</sup> O'Brien, Morrrough P. O'Brien. One of the more interesting anecdotes about Santa Barbara that O'Brien recalled was that the artificial harbor was really built for one particularly expensive yacht, owned by Max Fleishmann, of Fleishmann's Yeast. Fleishmann funded the breakwater. When the breakwater created so many unintended consequences to the nearby beaches, Fleishmann paid for O'Brien's consulting fees. When the Corps of Engineers' Beach Erosion Board proposed a sand transfer plant, and O'Brien explained why pumping the sand past the breakwater might actually work, the Santa Barbara County commissioners appropriated the money the same day to pay for the local contributions to the pumping station and on-going research.

<sup>473</sup> William Herron, "Oral History of Coastal Engineering Activities in Southern California, 1930-1981" (US Army Corps of Engineers, Los Angeles District, January 1986).

<sup>474</sup> Joseph M. Caldwell, "By-Passing Sand at South Lake Worth Inlet, Florida," in *Proceedings of First Conference on Coastal Engineering* (Long Beach, CA: Council on Wave Research, 1950). Sand bypassing plants that pumped sand past inlets and onto downcoast beaches became common solutions to shoaling and beach erosion problems in Florida and California in the 1950s. The volume of sand they were capable of pumping was not great enough to take the place of regular dredging operations for beach nourishment.

restoring eroding beaches, dredging and pumping sand would become the most common approach to maintaining popular, but ephemeral, shorelines after World War Two.

### **The emergence of the discipline of coastal engineering in World War Two**

Morrrough O'Brien's protégés in the fields of hydraulic and coastal engineering remembered him as always trying to look forward to where engineering practice was heading. In that sense "he foresaw the coming changes in engineering from a largely descriptive approach to an analytical basis and proceeded to guide the Berkeley and national education programs in this direction."<sup>475</sup> In the 1940's research in coastal engineering would move from empirical observation to formal, analytical methods.

During World War Two, the critical need to successfully execute amphibious assaults, especially in island-hopping campaigns in the Pacific theater, led to the training of dozens of Navy officers in techniques for wave forecasting, and many others in meteorology, undersea cartography, and antisubmarine warfare. Much of this training and research was sponsored by the US Navy's Bureau of Ships (BuShips). In 1936, the Navy Hydrographic Office first contracted with the Scripps Institution, newly under the direction of Norwegian oceanographer Harald Sverdrup, to develop quantitative methods for wave forecasting.<sup>476</sup> As a primary research contact for BuShips, O'Brien was influential in organizing data to support that effort. O'Brien was later given credit for his

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<sup>475</sup> Folsom and Wiegel, "Morrrough Parker O'Brien."

<sup>476</sup> William A. Nierenberg, "Harald Ulrik Sverdrup, 1888-1957," Biographical Memoir (National Academy of Sciences, 1996), <http://www.nasonline.org/publications/biographical-memoirs/memoir-pdfs/sverdrup-harald.pdf>. University of California President Robert Sproul recruited Sverdrup from Norway to run Scripps, which had become a "neglected" corner of the UC system in La Jolla, much to the Scripps family's frustration. Sproul took a personal interest in Sverdrup's success, much like he had done with E.O. Lawrence earlier. In particular, Sproul made sure Scripps had the resources to maintain its research ships and teaching mission. Sverdrup is recognized as the father of physical oceanography for his contributions to the analysis of ocean currents.

work on formally analyzing wave forces on pile structures, like those supporting oil rigs in deep water.<sup>477</sup>

Equations first developed at Scripps to forecast waves running up the gently-sloping nearshore bottom of the California coast were often inadequate to predict the complex patterns produced by barrier reefs in the South Pacific. As one Navy wave forecaster recalled after making observations for the assault on Peleliu in September, 1944:

“Almost immediately I made the disconcerting observation that the incoming swell did not behave according to the wave forecasting rules I had been taught...I handled this problem by using my forecasted waves only as a rough guide of what to expect, and relied primarily on my visual wave estimates and my judgment of the ability of amphibious vehicles to cross the outer reef margin and transit the reef to the beach.”<sup>478</sup>

This example of falling back on skills of empirical observation and experience would continue to be a common practice for coastal engineers after the War. As Robert Wiegel, who continued O’Brien’s work in formal methods for wave forecasting at UC Berkeley, wrote, “The author has been on hundreds of ocean beaches and rocky shores, in about 55 countries. Although coastal processes are general, their mix and environmental conditions are site specific.”<sup>479</sup> Because local conditions at coastlines were so complex, no matter how formalized analytical approaches became, there was no substitute for spending time

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<sup>477</sup> O’Brien, Morrough P. O’Brien. The Morison Equation was named after O’Brien’s graduate student who helped him carry out experiments on oscillating wave forces on models of ships’ hulls moving through the water. O’Brien said he really did not care who got credit for it. Berkeley hydraulic engineering professor Robert Wiegel later made the case that O’Brien really should be recognized for this fundamental contribution to fluid dynamics. For fixed structures, the Morison Equation derives the total linear force on an object by adding drag and inertia to the added mass created by the water that has to be pushed out of its way.

<sup>478</sup> Robert L. Wiegel, “Military Examples of Coastal Engineering” (Coastal Engineering Research Board, US Army Corps of Engineers, September 1999).

<sup>479</sup> Wiegel.



observing waves.

Research for the offshore oil industry on wave forecasting and construction materials also played a significant role in the development of coastal engineering as a community of practitioners. Long, wooden piers built to extend drilling into the nearshore portions of oil fields had been common since the 1890s. By the 1920s, forests of derricks covered the bluffs above beaches in Southern California, Caddo Lake on the Texas-Louisiana border, and lined the shores of the Caspian Sea near Baku.<sup>480</sup> These structures were often damaged by coastal storms, and so drilling further out into unprotected water, away from the sight of land, was not possible.

In the 1930s, American engineers who had worked in Southern California and Louisiana helped develop techniques for building concrete and steel platforms far out in Venezuela's Lake Maracaibo where a marine parasite had been destroying wooden structures. Lake Maracaibo is actually a large, tidal bay of the Gulf of Mexico. Because of its size and salinity, Lake Maracaibo became a "training ground" for marine construction and pipelining contractors. In October 1947, Kerr-McGee's exploratory rig struck oil 12 miles off the Louisiana Coast. It was the first truly offshore platform, beyond sight of land in the open waters of the Gulf of Mexico.<sup>481</sup> In that first case a surplus Navy barge was used as a "tender" to hold equipment and provide living quarters for workers. As the offshore industry learned to operate further off the coasts of Louisiana and California, former Navy equipment from the war would prove

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<sup>480</sup> F. Jay Schempf, *Pioneering Offshore: The Early Years*, vol. 1, Pioneering Offshore (Tulsa, OK: PennWell Custom Publishing, 2007).

<sup>481</sup> Schempf. Kerr-McGee's rig was actually in only 18 feet of water above the long, "ship shoal" sandbar formation. This offshore site was leased from the State of Louisiana.

indispensable.

In 1950, the University of California Extension, along with the Council on Wave Research,<sup>482</sup> sponsored the first coastal engineering conference in Long Beach, California. It was a location that connected the centers for research on nearshore dynamics – UC Berkeley and Scripps Institute of Oceanography – with the emerging offshore oil industry. Joseph Johnson, a mechanical engineering professor at Berkeley who had worked with Morrough O’Brien on equipment for amphibious assaults during the War, edited the proceedings. Johnson would organize the next sixteen coastal engineering conferences as it developed into an international community.<sup>483</sup> The following year 1951, Texas A&M University sponsored the second coastal engineering conference in Houston, Texas; another site that could connect civil engineers with pioneering offshore oil companies.

In the preface to the proceedings of the first conference at Long Beach, Morrough O’Brien wrote that coastal engineering was “not a new or separate branch of engineering,” but warned that “the design of coastal works does involve many criteria which are foreign to other phases of civil engineering and the novices in this field should proceed with caution.” O’Brien noted the unintended consequences of short-sighted interventions in dynamic, coastal processes:

“Along the coastlines of the world, numerous engineering works in various stage of

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<sup>482</sup> The Council on Wave Research was organized and funded by the Engineering Foundation. Morrough O’Brien was its first president. The Engineering Foundation sponsored research on behalf of the United Engineering Societies. In the 1950s, United Engineering Societies included ASME, ASCE, AIME, and ASEE. <https://www.uefoundation.org/the-uef-story/historical-timeline/>

<sup>483</sup> The biennial coastal engineering conference would eventually become an international forum; a worldwide community of scientists and practitioners. Later conferences would be sponsored by the American Society of Civil Engineers. The fifth conference, in 1954, was in Grenoble, France. The seventh conference, in 1960, was in The Hague, Netherlands.

disintegration testify to the futility and wastefulness of disregarding the tremendous destructive forces of the sea. Far worse than the destruction of insubstantial coastal works has been the damage to adjacent shorelines caused by structures planned in ignorance of, and occasionally in disregard of, the shoreline processes operative in the area.”<sup>484</sup>

From O’Brien’s view, the purpose of organizing a community of researchers and practitioners in specifically coastal engineering was to share the hard lessons learned from past failures and to design more skillful forms of infrastructure as coastal development accelerated.

### **Increasing federal involvement in coastal protection and oil leasing in the 1950s**

In the postwar era, the federal role in protecting coastlines increased dramatically. Locally-sponsored projects, such as municipal seawalls, breakwaters, and beach nourishment projects, became less common. Large federal projects carried out by the Army Corps of Engineers, in partnership with local governments, however, became far more common. The Corps’ mission expanded from improving navigation and flood control to shoreline protection, regardless of the specific shoreline’s connection with nearby harbors. And most projects to protect shorelines were really meant to protect the recreational value of a beach.

Infrastructure to protect harbors, however, remained critical. The very damaging 1954 hurricane season brought three powerful and destructive storms to the mid-Atlantic and New England. Hurricane Carol was especially devastating for communities along the coasts of Long Island, Connecticut, Rhode Island, and Massachusetts. In response, the Corps of Engineers initiated a program to design and build protective works for New

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<sup>484</sup> Johnson, *Coastal Engineering 1950*.

England harbors.<sup>485</sup> Some of the most ambitious works that were proposed included a long series of dikes across Narragansett Bay. The Corps' Waterways Experiment Station in Vicksburg, Mississippi, built a scale model of the bay in an old aircraft hanger, and ran storm surge experiments in it for four years before the plan was abandoned for a system of smaller-scale gates and pumping stations closer to the city of Providence.<sup>486</sup> Similar systems were built over the next two decades in the Charles River at Boston, New Bedford, Massachusetts, and New London, Connecticut.

Projects to protect coastal areas from intense storms were not limited to New England. For example, in the early 1960s new projects on the Gulf Coast, like a system of pump stations and levees at Texas City, TX, responded to high-risk areas where large-scale industrial infrastructure had recently been developed.<sup>487</sup> Texas City, located at the entrance to the Houston Ship Channel on Galveston Bay, was home to several refineries and oil storage areas that had been damaged by Hurricane Carla in 1961.

Each of these projects managed risk based on the data from previous storms, as well as “model storms” that simulated conditions that would surpass the 100-year flood. These were design practices; there was no mandated standard of protection or minimum threshold. For example, the project managers for the Texas City levees based their calculations to protect against a storm surge fifteen-foot storm surge, based on the

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<sup>485</sup> R. L. Wiegel, “Hurricane and Coastal Storm Surge Barriers in New England,” *Shore and Beach* 61 (1993): 30–49.

<sup>486</sup> Andrew Morang, “Hurricane Barriers in New England and New Jersey: History and Status after Five Decades,” *Journal of Coastal Research* 317 (January 2016): 181–205, <https://doi.org/10.2112/JCOASTRES-D-14-00074.1>.

<sup>487</sup> Wayne M. Murphy and Charles W. Geelan, “Development of Hurricane Flood Protection for Texas City, Texas,” in *Proceedings of the ASCE Conference on Coastal Engineering, Santa Barbara Specialty Conference* (ASCE, 1965), 889–920, <http://cedb.asce.org/cgi/WWWdisplay.cgi?14037>.

model hundred-year storm, and the actual recorded surge from the devastating 1900 Galveston storm.

In addition to the modeling studies for protective infrastructure first authorized by the Flood Control Act of 1954, Congress also began funding research that could lead to reducing the impacts of hurricanes. Congress directed the Corps of Engineers and the Weather Bureau to gather information on past hurricane impacts in order to better protect coastlines and provide more accurate storm warnings.<sup>488</sup> The Weather Bureau started a National Hurricane Research Project in 1955. This program launched the first Air Force research flights into hurricanes to better understand the storm's structure and development. The Corps of Engineers also had very good wind and wave data from gauges they had setup on Lake Okeechobee to measure the effects of a hurricane that passed through South Florida in the summer of 1949. Weather Bureau and Corps of Engineers investigators were active early participants in the coastal engineering research community.<sup>489</sup> During this time, the Office of Naval Research also sponsored research into the kinds of waves generated by large storms.<sup>490</sup> Federal sponsorship, in partnership with a growing number of universities, helped expand the community of coastal engineers. Berkeley's Robert Wiegel remembered that it was still a pretty small group in the 1950s. "We knew each other," he recalled. "we were colleagues who often

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<sup>488</sup> Theodore M. Hillyer, *The Corps of Engineers and Shore Protection: History, Projects, Costs*, National Shoreline Management Study (US Army Corps of Engineers Institute for Water Resources, May 2003), [http://www.nationalshorelinemanagement.us/docs/National\\_Shoreline\\_Study\\_IWR03-NSMS-1.pdf](http://www.nationalshorelinemanagement.us/docs/National_Shoreline_Study_IWR03-NSMS-1.pdf).

<sup>489</sup> Charles S. Gilman and Vance A. Myers, "Winds and Pressures in Hurricanes," in *Proceedings of 6th Conference on Coastal Engineering, Gainesville, Florida* (Council on Wave Research, 1957), <https://icce-ojs-tamu.tdl.org/icce/index.php/icce/issue/view/128>.

<sup>490</sup> J Collins, "Wave Statistics from Hurricane Dora near Panama City, Florida," in *Proceedings of the ASCE Conference on Coastal Engineering, Santa Barbara Specialty Conference*, 1965, 461–85.

collaborated, and often attended the same technical meetings. We crossed back and forth between engineering and science, between theory and practice, and between laboratory and field work.”<sup>491</sup>

The offshore oil industry was perhaps the greatest beneficiary of research into better understanding the kinds of waves produced by hurricanes. Because of earlier analytical work, companies had a better sense of what forces waves would put on pile structures supporting rigs in deep water. Mobile floating rigs, or “submersibles”, were another innovation of the 1950s.<sup>492</sup> There were still concerns about how big a storm could come through the Gulf of Mexico drilling sites and the maximum height of waves in open water.

The construction firm Brown & Root first demonstrated the value of their higher platform designs during the hurricane season of 1956.<sup>493</sup> They specifically built around the potential winds and waves generated by the level of a 25-year storm, which Hurricane Flossie proved to be that year. Brown & Root’s Executive Vice President, George Brown, recalled, “We had studied tides, currents, waves, and winds, and we knew that it wasn’t the winds that hurt, even hurricane force winds; it was the waves. The waves can batter the hell out of a platform. So we built our platforms high off the water so the waves couldn’t get to them. Our platforms were higher than the others, and we rode out the storms.”

When a series of much larger, “100-year” storms destroyed many rigs in the Gulf

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<sup>491</sup> Wiegel and Saville, “History of Coastal Engineering in the USA.”

<sup>492</sup> Schempf, *Pioneering Offshore*.

<sup>493</sup> Joseph A. Pratt, *Offshore Pioneers: Brown & Root and the History of Offshore Oil and Gas* (Houston, Tex: Gulf Pub. Co, 1997).

in the late 1960s, engineers redesigned their platforms from the joints up to account for greater wave heights and wind speeds. Because many earlier platforms had been built in the relatively calm decades after World War Two, Joseph Pratt points out that much of the knowledge about the destructive potential of storms in the open Gulf was “earned the hard way.”<sup>494</sup> Engineers developing offshore technology were able to share these hard lessons learned and improve their designs.

The growing success of deep water drilling led to years of jurisdictional disputes between the federal government and coastal states over who owned the undersea lands on the outer continental shelf. The “tidelands” dispute started in the late 1940’s and was not fully resolved until the early 1960s.<sup>495</sup> Texas and Florida claimed that they were entitled to lease drilling sites up to ten miles from land. The federal government wanted to enforce its claim to national territorial waters beyond only three miles controlled by the states. The Supreme Court initially upheld the federal government’s claim.

For Republicans in California and Texas, the politics of supporting state control of offshore drilling sites was clear. Retired General Dwight Eisenhower made a point of arguing for “states’ rights” to control the tidelands during his 1952 campaign for President, and this position helped him win the traditionally-Democratic state of Texas. His Vice-President, Senator Richard Nixon, had supported state control of near-shore

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<sup>494</sup> Joseph A. Pratt, “The Bold and the Foolhardy: Hurricanes and the Early Offshore Oil Industry,” in *The Challenge of Remaining Innovative: Insights from Twentieth-Century American Business*, ed. Sally Clarke, Naomi R. Lamoreaux, and Steven Usselman (Stanford, CA: Stanford University Press, 2009), 191–218.

<sup>495</sup> Price Daniel, “Tidelands Controversy,” *The Handbook of Texas Online*, June 15, 2010, <https://tshaonline.org/handbook/online/articles/mgt02>.

areas since his first election as a Congressman from the Los Angeles area in 1946.<sup>496</sup>

Environmental organizations such as the Sierra Club opposed state control of the tidelands on the basis that cash-hungry states would move rapidly to exploit offshore oil fields without considering environmental consequences to fisheries and recreational areas. Ultimately, a deal was reached where only Florida and Texas were granted ownership out to ten miles, and the other coastal states with offshore oil and gas leases, such as Louisiana and California, were limited to three miles. Now states could lease sites for offshore drilling with greater certainty. In 1969, however, a dramatic oil spill in the Santa Barbara Channel would become a galvanizing moment for the national environmental movement.

### **The impacts of environmental regulation**

Coastal development, both recreationally and for offshore oil drilling, continued throughout the 1960s. Along with it, a national movement for environmental quality became focused on issues of air and water pollution. Fires on the surface of the Houston Ship Channel caused by petroleum product waste, and again on Cleveland's Cuyahoga River in the summer of 1969, became symbolic of the consequences of unregulated industrial dumping in waterways. Earlier that year, the blowout at a Union Oil Company well in the Santa Barbara Channel - which resulted in tar washing up on miles of beaches for several months, and front page pictures of dying, oil-covered wildlife - also became a symbol for the environmental movement. President Richard Nixon's inauguration was only eight days before the Santa Barbara spill, and his administration at first moved

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<sup>496</sup> J. Brooks Flippen, *Nixon and the Environment* (Albuquerque: University of New Mexico Press, 2012), <http://public.eblib.com/choice/publicfullrecord.aspx?p=1118930>.



sluggishly to respond to the crisis.<sup>497</sup> With Democrats like Maine Senator Edmund Muskie taking a lead in calling for a suspension of drilling in the Santa Barbara Channel and sweeping national environmental legislation, Nixon sought to promote his own environmental leadership.

A year after the Santa Barbara spill, Nixon reluctantly signed the National Environmental Policy Act which would dramatically change the practice of coastal engineering in the United States. NEPA required the publication of an Environmental Impact Statement during the planning stage of any new, federal civil works project as well as for extensive modifications of existing infrastructure. EIS's had to consider how a project would affect ecosystems, livelihoods, and human health. Plans to mitigate potential environmental impacts had to be included in the EIS. Other federal agencies, such as the US Fish and Wildlife Service and the Environmental Protection Agency, were part of the extended environmental review process. Engineers were now forced to consult a wider range of experts than they had previously, and grassroots environmental groups could begin challenging projects in court even before they started. While NEPA may have been designed to prevent unintended consequences of interventions in natural systems, it also ended up dramatically increasing the cost and duration of everything from seawall construction to maintenance dredging.<sup>498</sup>

By the early 1970s, Port Authorities and the Army Corps of Engineers were more frequently involved in environmental regulatory cases. Many of these cases involved

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<sup>497</sup> Flippen.

<sup>498</sup> Robert A. Kagan, "The Dredging Dilemma: Economic Development and Environmental Protection in Oakland Harbor," *Coastal Management* 19, no. 3 (January 1991): 313–41, <https://doi.org/10.1080/08920759109362146>.

dredging projects to deepen harbors for larger ships that were part of an expansion of international trade.<sup>499</sup> While the goal of protecting coastal areas from flooding continued to be a negotiated process between developers and local, state, and federal sponsors, new environmental regulations instituted lengthy, formalized processes and minimum legal thresholds for managing waterborne pollution. Grassroots environmental organizations like the Sierra Club, National Audubon Society, and Environmental Defense Fund sued to block projects that would harm coastal wildlife, fisheries, and recreation. Sometimes these cases could delay port expansion projects for decades.<sup>500</sup>

For example, Federal regulation under NEPA conflicted with management by local authorities who had long been active agents of business expansion along the Houston Ship Channel. While pollution around downtown Houston's waterfront had been a Progressive cause in the early twentieth century, concerns about industrial and urban pollution were renewed in the late 1960s and early 1970s as oil and chemical spills intensified in the Ship Channel.<sup>501</sup> The perennial dredging of the Ship Channel to clear built-up silt brought concerns about where the Army Corps of Engineers should discharge the toxic sludge they removed.<sup>502</sup> Other environmental concerns included wastewater contamination from sprawling urban development and air pollution from refineries. By

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<sup>499</sup> Marine Board, National Research Council, *Dredging Coastal Ports: An Assessment of the Issues* (National Academies Press, 1985), <https://www.nap.edu/catalog/608/dredging-coastal-ports-an-assessment-of-the-issues>.

<sup>500</sup> Kagan, *Adversarial Legalism: The American Way of Law*.

<sup>501</sup> Hugh S. Gorman, "The Houston Ship Channel and the Changing Landscape of Industrial Pollution," in *Energy Metropolis: An Environmental History of Houston and the Gulf Coast*, ed. Martin V. Melosi and Joseph A. Pratt, History of the Urban Environment (Pittsburgh, Pa: University of Pittsburgh Press, 2007).

<sup>502</sup> Roy W. Hann and Welford S. Hutton, "Organic Sludges in the Houston Ship Channel: Their Source, Nature, Effect, and Removal," in *Proceedings of WODCON 1970; World Dredging Conference* (WODCON, 1970), <https://books.google.com/books?id=XevcmQEACAAJ>.

the early 1980s, a coalition of environmentalists, fisherman, and recreational boating interests successfully stalled plans to increase the depth of the Houston Ship Channel from 40 to 50 feet.<sup>503</sup> It would be another two decades before the dredging could be completed.<sup>504</sup>

These regulatory concerns pushed coastal engineers to consider a more holistic approach to management of the “coastal zone”.<sup>505</sup> The combination of industry, conservation, recreation and real estate interests in these areas created a need for more careful planning and management of beaches, wetlands, and navigation channels. The 1971 National Shoreline Study, conducted by the Corps of Engineers, first identified the coastal zone as a special space for integrated navigation, recreational, and conservation management.

“Shores and beaches are probably the most critical and valuable parts of the coastal zone. Shoreline land forms — rocky headlands, stable beaches, unspoiled salt marshes, bold shorelines — must strongly influence long range planning for land use in the coastal zone... The coastal zone is a uniquely valuable national asset. It is a magnet to living things. Nearly half of our population lives in counties that touch the sea or Great

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<sup>503</sup> Kiah Collier, “Port Authority Gets Green Light for Major Dredging Projects,” *Houston Chronicle*, accessed March 29, 2017, <http://www.houstonchronicle.com/news/transportation/article/Port-Authority-gets-green-light-for-major-5484906.php>.

<sup>504</sup> Marine Board, National Research Council, *Dredging Coastal Ports*. The delay in harbor dredging in the 1970s was not only because of environmental litigation. It was also because of the same constraints on the federal budget that were curtailing flood control projects. As the economy slowed and Congress tried to reduce budget deficits, annual appropriations for “maintenance” dredging projects continued while funds for “new construction” were easily blocked. Deepening harbors and channels was considered discretionary, “new construction”. In the 1970s, projects that had been authorized in the previous two decades did not get any new money in annual appropriations, no matter how hard local representatives pleaded for their ports to become more competitive globally. As the NRC’s Marine Board pointed out, “one of the characteristics of these public works expenditures is that all it takes to contain such expenditures is inaction. The annual funding approach reflected in the rivers and harbors legislation, therefore, required on the part of those congressmen opposing public works expenditures only that they refuse to join a consensus in funding authorized projects.”

<sup>505</sup> Armando I. Perez et al., “Environmental Protection Program for the Expansion of the Port of Miami, Florida,” in *Coastal Zone ’83: Proceedings of the 3rd Symposium on Coastal and Ocean Management*, vol. II, *Coastal Zone: Proceedings of the Symposium on Coastal and Ocean Management* (ASCE, 1983), 1090–1104.

Lakes...Shoreline management problems tend to be interwoven with coastal zone problems.”

This new understanding of the coastal zone was enshrined in the 1972 Coastal Zone Management Act which required states “to develop and implement management programs to achieve wise use of the land and water resources in the coastal zone, giving full consideration to ecological, cultural, historic and esthetic values, as well as compatible economic development.”<sup>506</sup>

### **The shift to nonstructural approaches and the regulation of coastal development**

In parallel with the rise of national and state-level environmental regulation, a paradigm shift was underway in how coastal engineers approached coastal protection. Decades of building concrete structures along coastlines had prevented some kinds of erosion and lessened the impacts of storm surge, but over time, relentless wave action and sediment transport carved deep pockets into jetty-reinforced beaches and undermined seawalls. Recognizing the long-run impermanence of hard, structural solutions led to new engineering approaches that emphasized the importance of working with natural processes instead of trying to overcome them. Coastal engineers recognized that “natural defenses” were often more effective at reducing the impacts of coastal storms than building structures like seawalls, groins, and rubble-hardened shorelines.<sup>507</sup> Supporting natural defenses meant taking a “non-structural” approach. Non-structural approaches emphasized projects like restoring dunes, dredging sand for beach nourishment, and

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<sup>506</sup> Hillyer, “The Corps of Engineers and Shore Protection,” 8.

<sup>507</sup> Hillyer, “The Corps of Engineers and Shore Protection”; Wiegel and Saville, “History of Coastal Engineering in the USA.”

protecting wetlands.<sup>508</sup>

As early as 1953, the Army Corps of Engineers had studied structural interventions along the coast of Southern California and declared in a report to Congress that “where conditions permit, probably the best means of protecting a beach or shoreline against erosion of any type is to introduce a sandfill between the shoreline to be protected and the ocean and then to maintain that protective fill against long-term erosion.”<sup>509</sup> This kind of on-going beach nourishment project became common in both California and Florida by the late 1960s. The prioritization of non-structural approaches also led to a wider diffusion of technologies like sand bypassing pumps to mitigate the side effects of earlier works.<sup>510</sup> Beach nourishment was meant to be a form of intermittent maintenance rather than a permanent solution that vainly attempted to hold an arbitrary edge in a dynamic environment.

As the development of coastal areas vulnerable to storms and erosion continued, the federal government became a more active sponsor of shoreline maintenance. By the late 1950s, Congress gave approval for the federal government to cover the majority of the costs of beach restoration and hurricane protection works, in partnership with local

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<sup>508</sup> Dornhelm, “The Coney Island Public Beach and Boardwalk Improvement of 1923.” Coney Island actually exemplifies an early case of a consulting engineer recognizing the need for continual beach nourishment. Coney Island’s large artificial beach had been constructed on top of groins from dredged sand in 1923. Philip Farley, consulting engineer for the Borough of Brooklyn who had designed the artificial beach, recommended nourishment by pumped sand every three years. The Borough did not follow through on this maintenance schedule. With its boardwalk, Coney Island became an iconic weekend destination for New Yorkers, but by 1930 the beach had eroded considerably.

<sup>509</sup> US Army Corps of Engineers, “Beach Erosion Control Report on Cooperative Study of Pacific Coast Line of the State of California” (US Congress, November 3, 1953), <https://catalog.hathitrust.org/Record/009676869>.

<sup>510</sup> PM Bruun, “By-Passing and Backpassing with Special Reference to Conditions in Florida,” in *Proceedings of the ASCE Conference on Coastal Engineering, Santa Barbara Specialty Conference* (ASCE, 1965), 561–626.

authorities. A number of local authorities took advantage of the opportunity to secure significant federal funding for infrastructure that would reduce flooding from coastal storms. The Flood Control Act of 1962 increased federal cost-sharing to fifty-percent of projects that would protect public beaches, and it required the Corps of Engineers to entirely cover the costs of shoreline erosion studies.<sup>511</sup> In 1965, Congress enshrined *recreational uses* of the coast as worthy of considering in the Corps of Engineers' cost-benefit calculations for shoreline protection. This official widening of the scope of cost-benefit calculations recognized the massive development of resort beaches, islands, and estuaries that intensified after World War Two, especially along the Southeast Atlantic and Gulf Coasts. Recreational uses of waterfronts now drove economic development in coastal areas across the sunbelt.

Ted Steinberg cites the example of the Corps of Engineers' huge, multi-decade project to restore Miami Beach's namesake feature with dredged sand from shallow areas off the coast.<sup>512</sup> Starting in the 1920s, hotels began building pool decks directly on top of the dunes and shoreline. Hotels and the city also sponsored the construction of jetties to stabilize erosion. Each hotel's "private beach" was demarcated by a jetty. By the early 1960s, however, the beach at Miami Beach had eroded almost completely away in some sections. At many hotels, beachgoers had to use a ladder to descend seawalls directly into the ocean at high tide. Citing both recreational benefits as well as storm protection, the city of Miami Beach and the State of Florida were able to lobby the federal government to pay for most of the cost of rebuilding the beach. But in return for this national

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<sup>511</sup> Hillyer, "The Corps of Engineers and Shore Protection."

<sup>512</sup> Steinberg, *Acts of God: The Unnatural History of Natural Disaster in America*, 87.

investment, the hotels had to give up their claims to ownership of sections of the beach. The shoreline at Miami Beach became a public park, and the first defense against a direct hit by a hurricane.<sup>513</sup>

By the mid-1980's another policy change was underway. Non-structural approaches could be used to protect property developed in ignorance of the fragility of the shoreline, but it would be even better to leave barrier islands in their natural state. Regular beach nourishment and wetlands restoration projects had become a form of subsidy for developers and coastal states.<sup>514</sup> The Coastal Barrier Resources Act of 1982 restricted most Federal funding for largely-undeveloped shorelines, islands, and estuaries. These remaining, mostly-natural areas were put into a system of reserves mapped and enforced by the US Fish and Wildlife Service. The system, re-named after Rhode Island Senator John Chafee in 1999, now includes 1.3 million acres of barrier islands and aquatic areas. States were encouraged to protect their own coastal lands from development as recreational and natural areas. Since 1982, another 1.9 million acres of the coastline has become part of a state park.<sup>515</sup>

The Corps of Engineers also began to emphasize environmental protection as a key mission, alongside flood control and coastal defense. Starting in 1970, the Corps' Environmental Advisory Board began to review on-going projects for their

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<sup>513</sup> Steinberg notes, however, that even this massive project was not designed to protect Miami Beach from the kind of storm surge that devastated the city in the 1926 hurricane. Rather, the model of the 70-year storm was used for beach slope elevations and dune cover.

<sup>514</sup> Hillyer, "The Corps of Engineers and Shore Protection."

<sup>515</sup> "Coastal Barrier Resources System," US Fish and Wildlife Service, June 8, 2015, <https://www.fws.gov/ecological-services/habitat-conservation/cbra/Act/index.html#CBRS>.

environmental impact.<sup>516</sup> The Water Resources Development Act (WRDA) of 1986 legislated this new set of priorities.<sup>517</sup> Along with the first large-scale dam started since the late 1960s, WRDA 1986 authorized dozens of new shoreline protection and water resources conservation projects specifically designed to protect or restore sensitive coastal ecosystems. For example, it authorized more than \$140 million for the protection and restoration of barrier islands around Florida that would become part of the John H. Chaffee Coastal Barrier Reserves System. It also authorized modifications to many existing projects, such as the unfinished Cross-Florida Barge Canal, to prioritize environmental restoration. WRDA 1986 also shifted some of the costs back onto the states, local port authorities, and users of inland waterways through new taxes on cargo, barge fuel, and mandatory state contributions to construction costs.

## **Conclusion**

During the twentieth century, coastal engineering moved from local, civic “experiments” to protect seaside resorts to a discipline that could scientifically design offshore platforms to withstand some of the most intense conditions on earth. At the same time, coastal engineers came to accept the dynamic nature of the coastal zone and promote preservation of natural coastlines as the best protection against storms.

In the twenty-first century, adaptation to the impacts of climate change will inevitably be the main focus of engineers who work in the coastal zone. The need to protect the massive investment in coastal property may well bring a return to hard, structural approaches, such as the seawall that protected Galveston Island for a little more

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<sup>516</sup> Reuss, “Shaping Environmental Awareness.”

<sup>517</sup> Reuss, “Reshaping National Water Politics.”



than a hundred years.<sup>518</sup> Miami Beach is only one example where flood control systems, such as raised streets, culverts, and pumping stations, are being designed to protect the island from higher tides. As climate change brings higher tides, combined with stronger storms, these efforts will be perpetual undertakings to protect our most vulnerable coastlines.

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<sup>518</sup> Davis, “History of the Galveston Sea Wall”; “Hurricane Harvey Is a Seawall Moment for Houston,” *Houston Chronicle*, August 31, 2017, <http://www.houstonchronicle.com/opinion/editorials/article/Hurricane-Harvey-is-a-seawall-moment-for-Houston-12165697.php>. The 10-mile long Galveston Sea Wall, completed in segments between 1904 and 1963, protected the island from hurricane storm surge until Hurricane Ike in September, 2008. The Sea Wall blocked the 17-foot surge on the Gulf side of the island, but water from the intracoastal side quickly flooded downtown areas. High winds damaged houses throughout the island. In many ways, it was a reprisal of the terrifying 1900 storm that first created awareness of the region’s vulnerability. On the other hand, a hundred years of protection is a pretty good track record for a primary flood control system. If public policy and market forces cannot push people away from the coastlines, then perhaps we need to invest in the structures that can protect them.

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### **Bibliographic Essay**

#### Houston

Documents on flood control in Houston can be found in several local archives. The main Houston source for this dissertation is the Harris County Archives. The collection of *County Auditor's Papers* from 1936-1960 is particularly valuable to understanding the development of the Harris County Flood Control District and its relationship to the federal Buffalo Bayou and Tributaries Project. The *Auditor's Papers* also contain minutes of the Houston Chamber of Commerce, Flood Control Committee, that was particularly influential in advocating for expanded flood control in the late 1940s and early 1950s. The Harris County Archives also feature unusually comprehensive scrapbooks of local newspaper articles collected by long time county commissioner *E. A. "Squatty" Lyons*. Better than any search engine, *Squatty Lyons's collections* are a comprehensive database of news on county projects, especially roads and flood control, during the 1940s and 1950s.

For a better understanding of the role of the Port of Houston in planning flood control projects in the late 1930s, the *J. Russell Wait Port of Houston Collection* at the Woodson Research Center at Rice University libraries is highly valuable. Also pertinent to the early years of the project are the *Albert Thomas Papers*, from Houston's Congressman during the New Deal and World War Two.

The work of grassroots environmental organizations to oppose flood control in Houston the late 1960s and early 1970s is discussed extensively by Teresa Tomkins-Walsh in her unpublished 2009 dissertation *A Concrete River Had to Be Wrong: Environmental Action on Houston's Bayous, 1935–1980* (University of Houston, 2009). The collections Tomkins-Walsh has put together as a historian and archivist for the University of Houston libraries are essential for understanding the environmental movement in Houston. These include the *Terry Hershey Papers* from one of the city's greatest environmental activists, and the *Bayou Preservation Association Collection*, the organization Terry Hershey founded.

Records of the US Army Corps of Engineers, Galveston District, are supposedly available through the National Archives in Fort Worth. The *Civil Works Project files* cover the period when the Buffalo Bayou Project was being planned and constructed (1937-1948), but they were not included in this research due to time constraints. The most thorough overview of the history of the Corps of Engineers' work in water resources management is *Two centuries of experience in water resources management: A Dutch-U.S. retrospective* (Alexandria, VA, 2014) edited by John Lonnquest, Bert Toussaint, Joe Manous and Maurits Ertsen. This extraordinary international comparison was published by the Corps' Institute for Water Resources and the Dutch Ministry of Infrastructure and Environment, Rijkswaterstaat.

### Miami

The Central and Southern Florida (C&SF) Project to control flooding in the Everglades after the floods of 1947 has been widely studied. This dissertation relies extensively on two narratives, *The Swamp: the Everglades, Florida, and the politics of*

*paradise* (New York, 2007) by Michael Grunwald and *River of interests: water management in south Florida and the Everglades, 1948-2010* (Washington, DC, 2011) by Matthew Godfrey and Theodore Catton, for Historical Research Associates and the Jacksonville District, US Army Corps of Engineers.

I supplemented these thorough accounts with documents from the HistoryMiami Research Center. The *Jeanne Bellamy Water Resources Collection* documents the origins of the C&SF Project in the late 1940s and its evolution over the next three decades. Jeanne Bellamy was a reporter for the Miami Herald and served on several state-level Citizen's Committees on flood control and environmental protection during those years. A thorough collection of government documents on the C&SF project is available at Florida International University's libraries.

Beginning in the mid-1990s, records on the C&SF Project, as well as the Four River Basins Project in the Tampa area, were transferred from the US Army Corps of Engineers, Jacksonville District, to the National Archives at Atlanta (located in Morrow, GA). Many of these records became publicly available as late as 2015. Due to deadlines and the incredible volume of these materials, few of them were analyzed for this dissertation. The *Records of the Office of the Chief of Engineers, Jacksonville District, Civil Works Project Files* (Record Group 77) from 1945-1985, remain an essential source for future scholarship on flood control in Florida.

### Tampa

Some of the best sources on the history of the Southwest Florida Water Management District are oral history interviews with some of its founders and longtime leaders. Interviews with former Chairman Derrill McAteer (1967-1980) and former

Executive Director Dale Twachtmann (1962-1972) are available online from the *Samuel Proctor Oral History Program Digital Collection* at the University of Florida Digital Collections. The *Florida Water Management Oral History Collection* at UF includes many other interviews with water managers and influential politicians in Florida's 1970s environmental transformation.

Several collections at the University of South Florida Libraries also cover water management issues in the Tampa Bay Area. These include the *Sam Gibbons Papers*, the *Jan K. Platt Papers*, and the *Terrell Sessums Collection*. These collections touch on the perspective of government on multiple levels: Gibbons represented the Tampa area in Congress beginning in the 1960s, Platt held city and Hillsborough County commission offices in the 1970s, and Sessums was a Florida State representative during the 1960s.

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